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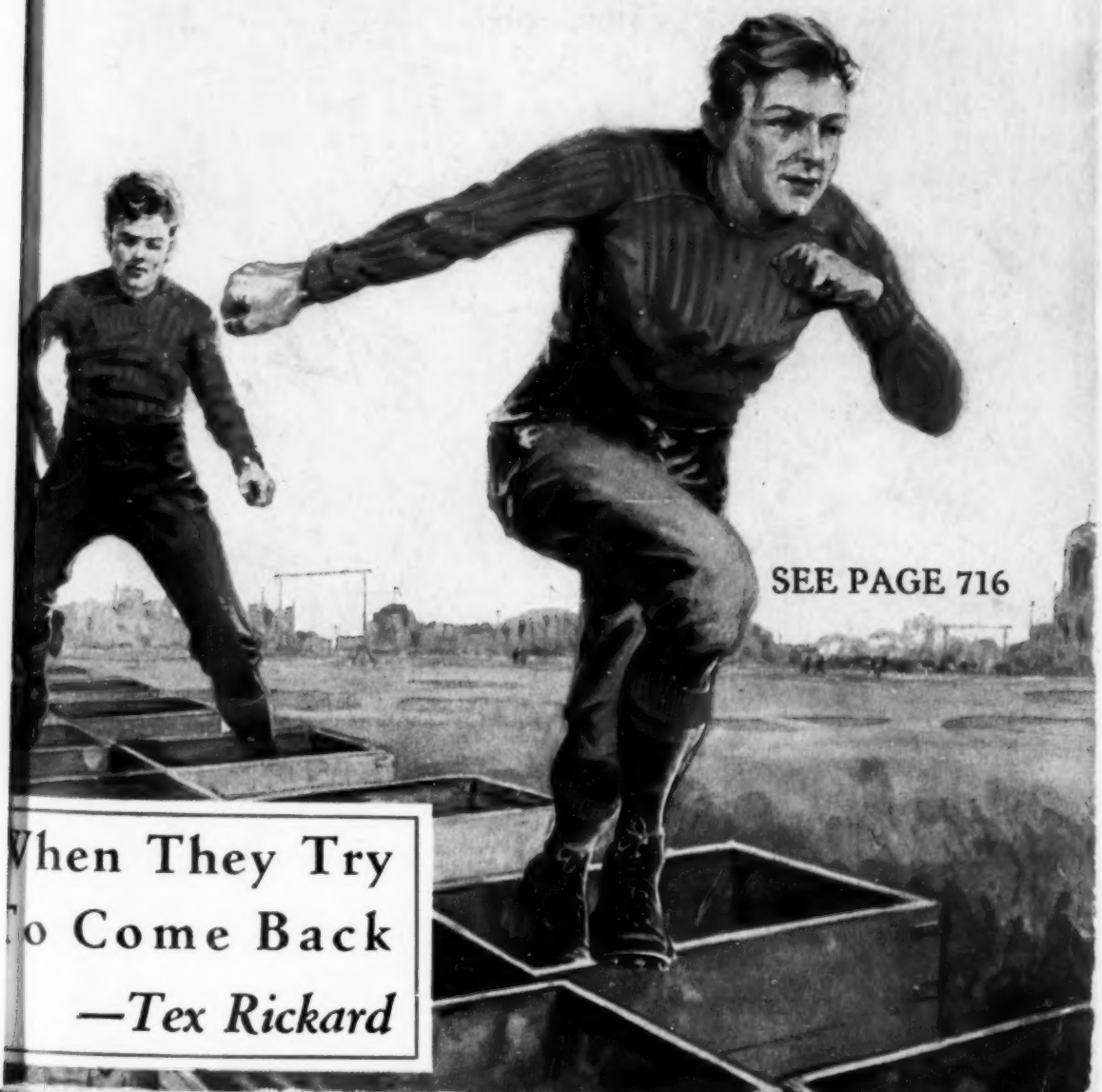

SEE PAGE 716

When They Try To Come Back

—*Tex Rickard*

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A genuine ATKINS "Silver Steel" Cross Cut Saw will save you more than it costs.

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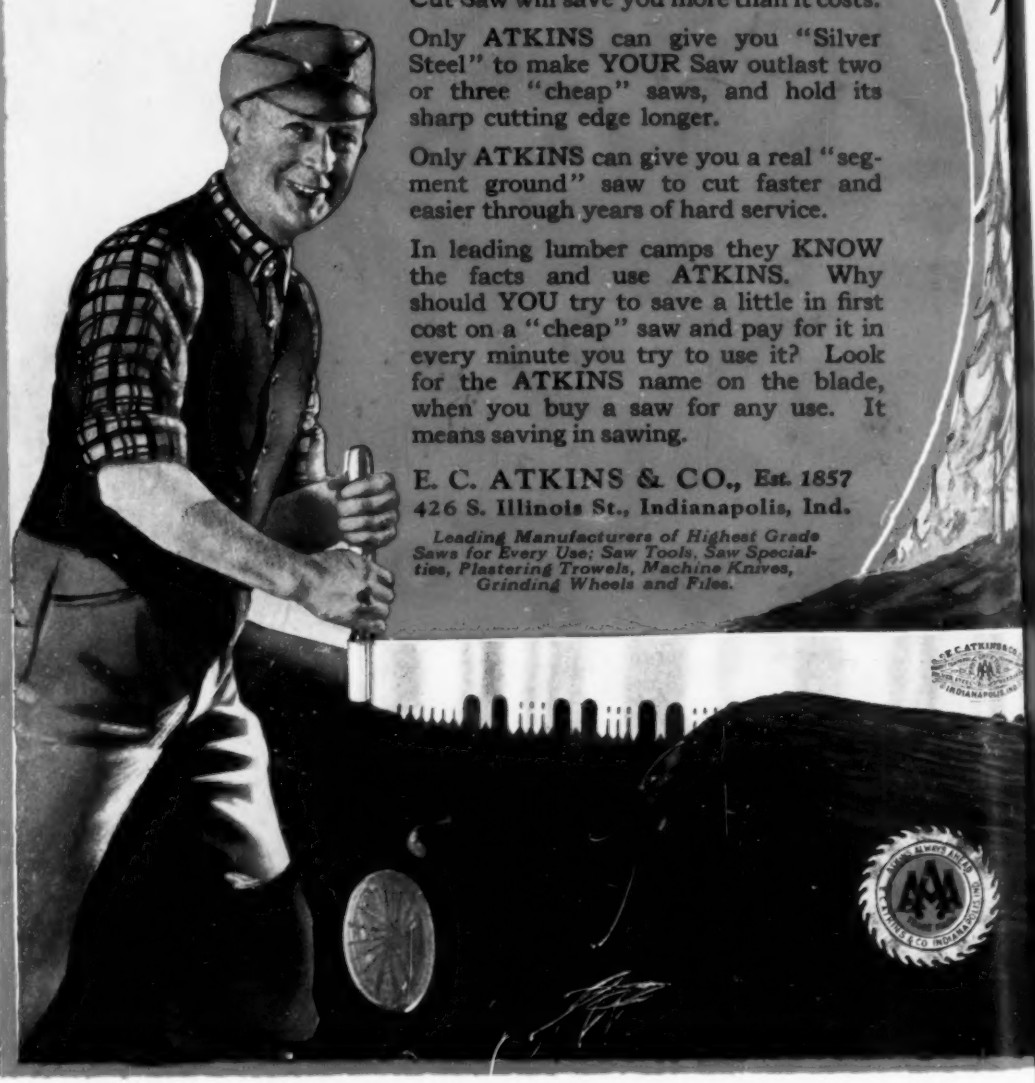
Leading Manufacturers of Highest Grade Saws for Every Use; Saw Tools, Saw Specialties, Plastering Trowels, Machine Knives, Grinding Wheels and Files.



... Modern

Here is the Eveready Layerbilt "B" Battery No. 486, Eveready's longest-lasting provider of Battery Power.

Radio is better with *Battery* Power

NOT because they are new in themselves, but because they make possible modern perfection of radio reception, batteries are the modern source of radio power.

Today's radio sets were produced not merely to make something new, but to give you new enjoyment. That they will do. New pleasures await you; more especially if you use Battery Power. Never were receivers so sensitive, loud-speakers so faithful; never has the need been so imperative for pure DC, Direct Current, that batteries provide. You must operate your set with current that is smooth, uniform, steady. And only from batteries can such current be had.

So batteries are needful if you would bring to your home the best that radio has to offer. Choose the Eveready Layerbilt "B" Battery No. 486, modern in construction, developed exclusively by Eveready to bring new life and vigor to an old principle —actually the best and longest-lasting Eveready Battery ever built. It gives you Battery Power for such a long time that you will find the cost and effort of infrequent replacement small indeed beside the modern perfection of reception that Battery Power makes possible.

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WSAI—*Cincinnati* WGY—*Schenectady*
WTAM—*Cleveland* WHAS—*Louisville*
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WGN—*Chicago* WSM—*Nashville*
WMC—*Memphis*

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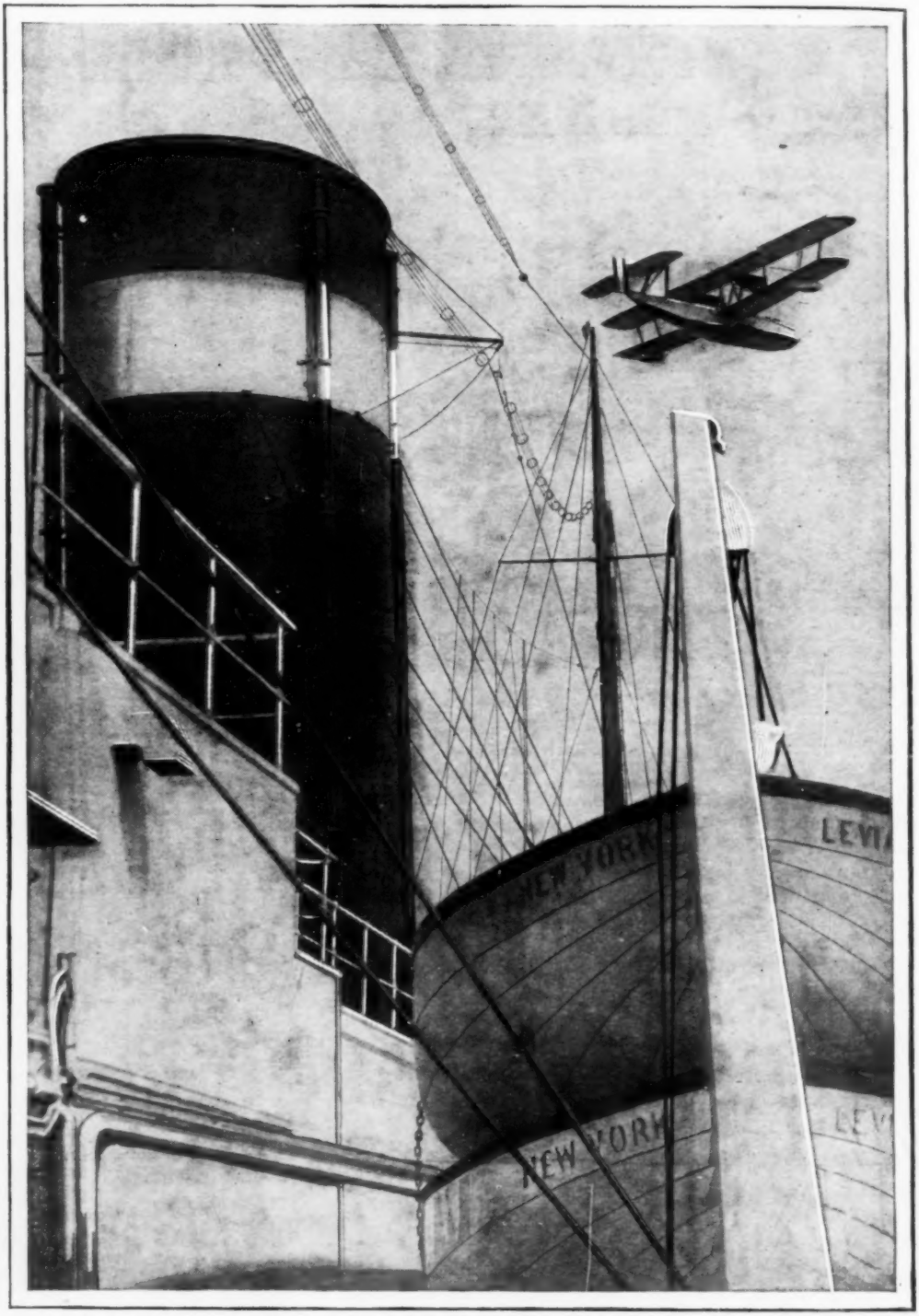
—they last longer

The air is full of things you shouldn't miss



Lieut. Charles H. Schildhauer, U. S. N., Flying over the "Leviathan" in His Big "PN-10" Bomber, to Gauge the Size of the Target, on Which He Later Was Prevented from Dropping His Mail Bags Because of a Thick Fog, 500 Miles at Sea, Which Made It Impossible to Find the Ship

Popular Mechanics Magazine
REGISTERED IN U. S. PATENT OFFICE
WRITTEN SO YOU CAN UNDERSTAND IT

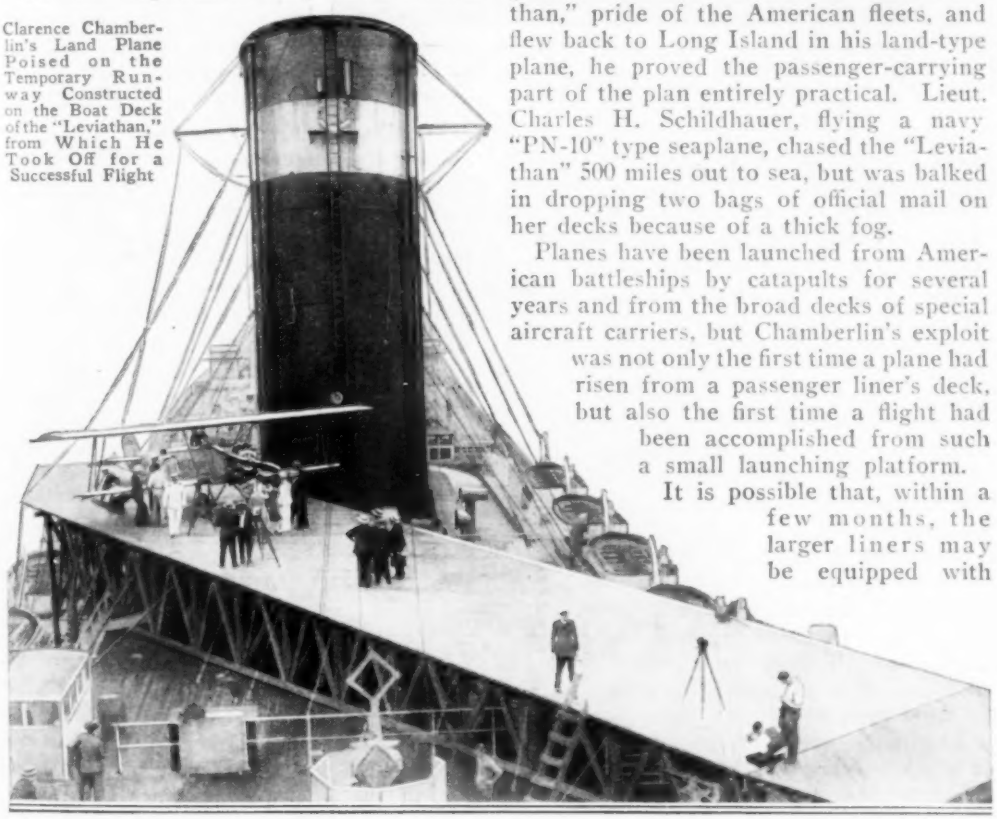
Vol. 48 NOVEMBER, 1927 No. 5

Speeding the Overseas Mail

Airplanes, Flying to Ships off Shore and Returning with Letters and Passengers, May Cut Trip across Atlantic by Two Days

CUTTING a day to a day and a half off the mail time from New York to Europe, the United States shipping board and post office have joined in paving the way for a combined airplane and steamer service which may eventually reduce even the passenger time across the Atlantic from five to three days, or less.

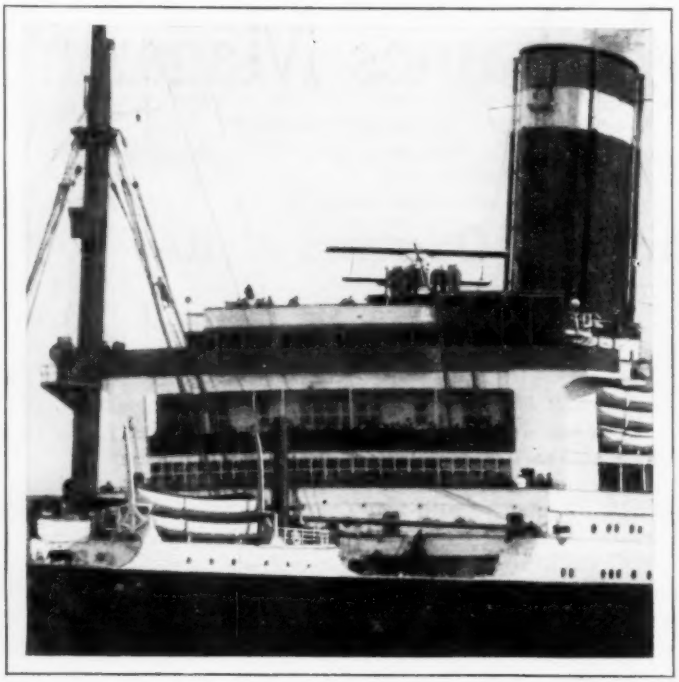
In one experiment they have shown the practicability of landing mails and passengers from ocean liners while they are still a day and more out at sea, and plans have been made to deliver mail to outbound ships the same distance from land. When Clarence Chamberlin, hero of the New York to Germany non-stop flight, took off from an improvised flying platform on the boat deck of the "Leviathan," pride of the American fleets, and flew back to Long Island in his land-type plane, he proved the passenger-carrying part of the plan entirely practical. Lieut. Charles H. Schildhauer, flying a navy "PN-10" type seaplane, chased the "Leviathan" 500 miles out to sea, but was balked in dropping two bags of official mail on her decks because of a thick fog.



Clarence Chamberlin's Land Plane Poised on the Temporary Runway Constructed on the Boat Deck of the "Leviathan," from Which He Took Off for a Successful Flight

Planes have been launched from American battleships by catapults for several years and from the broad decks of special aircraft carriers, but Chamberlin's exploit was not only the first time a plane had risen from a passenger liner's deck, but also the first time a flight had been accomplished from such a small launching platform.

It is possible that, within a few months, the larger liners may be equipped with



Chamberlin's Plane on the Runway, More Than a Hundred Feet above the Sea, Ready for the Flight

catapults, just like battleships, for the navy has demonstrated that big seaworthy flying boats of the Loening amphibian type can be launched into the air by the latest style power-propelled catapults with the same ease as small pursuit and observation planes. Using Loening or similar airplanes, it would be possible to send important mail in from a ship 500 to 800 miles at sea, and even passengers with urgent business ashore could be ferried in through the air. In effect, the passenger liners would take the place of the floating islands proposed by several aviation authorities to make transoceanic flying feasible.

The dropping of mail sacks onto outbound ships, making it possible to catch them with mail that did not arrive until the day after they sailed, is a simple task, given enough visibility for the flyer to find the ship. A trained bomber can hit a target the size of the "Leviathan" from a height of several thousand feet, but it is not necessary to take even that chance in delivering mail aboard ship, for the plane can come so low it barely clears the upper decks, making a miss impossible.

If such a service is established on this side, it is considered certain that foreign countries, particularly England, will follow suit, and, if not, the ships' own planes, operated by the steamer lines, could duplicate the service overseas and save another day, day and a half or two days.

Such a saving is more than a stunt, for every minute's delay in the transmission of financial papers may cost thousands in interest. Uncle Sam recognized that years ago when he organized the marine mail service in New York harbor. In the old days, an arriving liner docked, discharged her passengers and cargo, and then, after twenty-four to forty-eight hours' delay, leisurely unloaded her mail sacks on the pier.

Now the government-owned mail boat "President," assisted by a fleet of steam lighters, meets arriving liners at quarantine, or even, occasionally, outside the harbor when they are fog-bound, and takes their mail sacks aboard to rush them up the harbor and into waiting trucks and mail cars for distribution all over the world. Cargoes of five or six thousand sacks of mail are not unusual on the larger liners, and often hours, or even a day, is saved in getting them on their way. Mail from steamers arriving in the morning is frequently sorted, dispatched and delivered to New York, Philadelphia and other points in time for financial papers to go through the clearing house the same day.

Not all the mail arriving in New York harbor is destined for American cities. Vast quantities come for reshipment to Canadian points, and across the continent to steamers bound for China, Japan, New Zealand and the islands of the Pacific. Special mail trains are made up and waiting on the docks when the "President" comes in. Sometimes they are held for an hour or more at the government mail pier

to take on bags destined for the other side of the Pacific, thereby catching a steamer and saving ten days in reaching the mail's destination.

More than a million incoming mail sacks were handled in New York in 1926, and the number for this year is estimated at 1,200,000, or something like 50,000,000 pounds of mail. This averages sixty-odd tons a day throughout the year. Postal officials estimate that 500,000 sacks will contain first-class mail, or about one and three-quarter billion letters, from overseas. More than 1,600 mail ships docked in New York last year. One day the "Berengaria" broke the records of all time by coming in with 11,552 sacks in her holds.

When the big liners sail from the other side, they report by wireless the time of their arrival and the number of sacks aboard, and when they reach quarantine, where they must anchor for health inspection, the "President" is waiting to dash alongside. While her lines are being made fast, a canvas chute is rigged and the sacks begin coming down to the waiting force of clerks and sorters. If the steamer has a heavy mail cargo, a lighter ties up on the other side, to double the discharge rate.

The handlers and sorters classify the bags as they check them off on the invoice list, and by the time the "President" reaches her dock, they are ready to load the New York district mail onto trucks, the American and Canadian sacks into the proper trains, the trans-Pacific allotment to the cross-continent cars, and the South American mail is sent to the proper ship docks. "The President" is on duty twenty-four hours a day, and has three captains and three full crews, to man the three eight-hour shifts.

Enjoying His Own Private Sun Porch; Cabinet for Baby Adjusted to Window Ledge

WINDOW SUN ROOM FOR BABY HELPS DEVELOP HEALTH

Sun baths in a specially constructed window booth have helped develop a prize-winning Brooklyn baby, doctors declare. There is a strap to keep the child from falling out, and the booth has curtains.

LINER'S LIFE BELTS FOR DOGS LATEST TRAVEL CONVENIENCE

Safety for Dogs as Well as Passengers on New Steamer; the Preservers Are in Three Sizes

Dangers of ocean travel have been reduced to a minimum, but passengers on the "Ile de France," accompanied by their pet dogs, have extra assurance that the animals will also be protected in case of an emergency, as special life belts for the dogs are part of the steamer's equipment. They are quickly strapped on and are made in three sizes for big and little dogs. The plan has received favorable comment from various humane societies.

WILD ANIMALS RETURNED TO "LIFE" IN MUSEUM

Courtesy Field Museum of Natural History

Corwin Painting a Scene; C. J. Albrecht, Who Collected and Prepared the Group, with Deer He Has Just Shot, and the Finished Display as It Appears in Museum Cabinet

So that wild life may be more accurately studied and appreciated by means of museum exhibits, artists, taxidermists and photographers unite in preparing animal and other groups with exacting care. This is illustrated in the recently completed mule-deer booth at the Field museum of natural history. The animals were killed in the Kaibab forest in northern Arizona, and within a few minutes after they were shot, casts were made of their heads for accurate reproduction in the models. These death masks preserved the natural expression. Skins and larger bones, excepting the backbone, were taken to the museum laboratories and, while these were being made ready, Charles A. Corwin, museum artist, made paintings of actual scenes in the forest area. These paintings furnished the material for the colorful and realistic background in the case. The skull and larger leg bones were used in forming the skeleton upon which to mold the animal model. A composi-

tion substance was employed and, when it was ready, the skin was carefully adjusted over it. The work of grouping the animals in lifelike manner and arranging each in a convincing pose was a special task in itself. One of the aids in this work was a small model of the display, fashioned in a miniature case with a painted background, lighting, and other details that would suggest almost exactly how the completed group would look.

COWS DRAW DRINKING WATER ON PRINCE'S FARM

Among the modern improvements on the Nottingham farm owned by the Prince of Wales, in England, is an automatic drinking trough for cattle. The animals press their noses on it at the sight of a small quantity of liquid, and the force releases a fresh stream which stops as soon as the cows lift their heads. This reduces waste by evaporation and insures a supply of fresh water at all times.

AUTO SHIELD PREVENTS GLARE BY DAY OR NIGHT

Greater safety and comfort in day or night automobile driving is afforded by an adjustable celluloid shade attached to the windshield and easily regulated according to the driver's needs. When not wanted, it is readily swung entirely out of the line of vision.

Protecting the Eyes from Glare While Driving; the Adjustable Shield in Place on Auto

Shoulder Umbrella in Place, Showing How It Leaves the Hands and Arms Free for Work

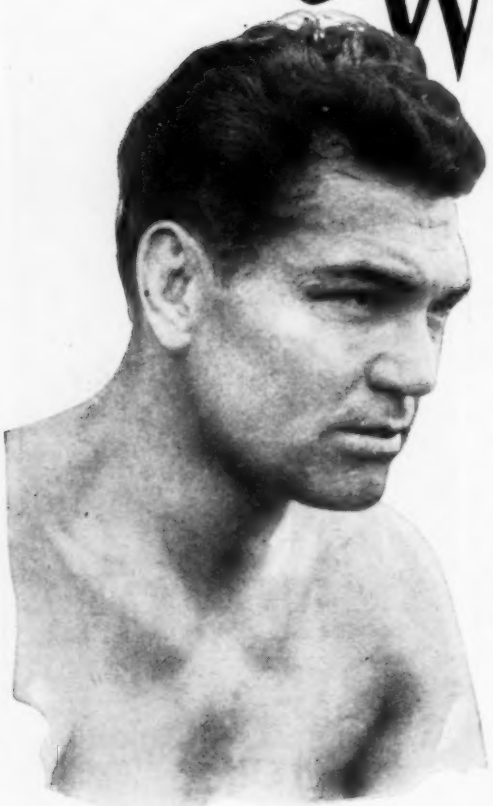
WEAR UMBRELLA ON SHOULDERS TO LEAVE HANDS FREE

Umbrellas or sunshades are often a bother, especially when climbing or working outdoors, but German craftsmen have found a way to eliminate this difficulty by constructing a canopy arrangement that is worn on the shoulders, leaving the hands free. It is light in weight, strongly braced with steel tubing, and can be folded when not in use. It has proved especially popular among gardeners, artists and others who work out in the open.

LIGHTNING ROD GUARDS TREE VALUED AS LANDMARK

Because of its associations and abundant shade, a hickory tree near the summer home of a Wisconsin man is so highly valued that lightning rods have been attached to it to protect it in storms. The house is not so guarded, the builder declaring that he could erect another but the tree could not be replaced.

WHEN *they*



Jack Dempsey, Unshaven and Scowling, as He Appears When He Enters the Ring for a Fight

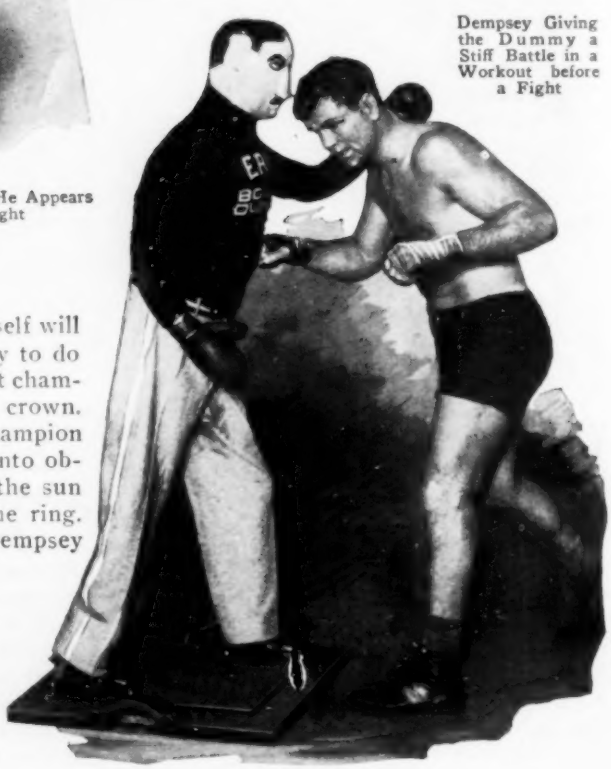
By TEX RICKARD

(As told to A. A. Albelli)

NO one but Jack Dempsey himself will ever know what it cost to try to do what no other world's heavy-weight champion has ever done—regain a lost crown.

Usually a champion or a near-champion gets knocked out and fades fast into oblivion. There is nothing under the sun which can entice him back to the ring. He's through. But, you know, Dempsey was not knocked out when he lost his championship. If Tunney had put him away in Philadelphia, I do not think he would have ever made his way back to the front lines this year. The mental hazard would have been against him. A knock-out is bound to spell the end of a champion. That is what it has done in every case heretofore. Somehow, the dethroned champion of the past has never risen out of the depths of defeat. It hangs over him like an everlasting doom. It takes a mighty fighting man to brave the hardships and hazards that lie in the way of a come-back.

If it does not seem too presumptuous on my part, I might venture to say that I know Jack Dempsey better than any other man. I have studied him for years. I know him as a man and I know him as a fighter. Of course, I do not mean to draw conclusions from the Tunney match. So I shall leave Tunney out of the discussion. It is Dempsey, the phenomenon of the prize ring, who interests me.



Dempsey Giving the Dummy a Stiff Battle in a Workout before a Fight

try to Come BACK

Bud Taylor Using Both Left and Right on Tony Canzoneri Just before the End of Their Battle, in Which Taylor Won the Bantam-Weight Crown; Several Championships Are Now Vacant

Every world's heavy-weight champion has tried to come back after losing his crown. Great fighters of modern times, like Jim Corbett, Bob Fitzsimmons and Jack Johnson, tried to get back to the top. But they failed. There was something saddening in their failures. They were beaten by Father Time. In the ring game the onrushing years mean the downrushing ability of the fighter.

Circumstances for a come-back were different during the early part of the century. When Jim Corbett came back to recapture what Bob Fitzsimmons snatched from him in that memorable fight in Carson City, Nev., in 1897, he did not have to step across a third gladiator to reach his old crown. Nor did Fitzsimmons later have to cross gloves with any other than the mighty Jim Jeffries. And then, after Jeffries retired, he did not have to make his way across pugilistic battlefields. He had been in retirement for five years when he tried to climb back. The title was still his when he fought Jack Johnson, in 1910. But the idleness of Jeffries told. Here, also, time took its toll.

And when Johnson met Jess Willard in the sun-scorched ring in Havana, time and indolence were again fatal factors. Johnson's skill and stamina had waned. Johnson could not come back. Willard stretched him out there and put a finis to the career of a great fighter. Idleness and time proved a nemesis for Willard too. He never had any great desire to fight after he won the crown in 1915. Eventually, defying time and tradition, he tried to come back and defend his title against the youthful and almost nondescript Dempsey at Toledo. That was in 1919. You remember how Willard was put away in the third round. Another failure.

That knock-out doomed Willard. Once, years later, he tried to leap back into the spotlight when he fought Luis Firpo. You remember how Firpo knocked him out in the eighth round.

Incidentally, the New York boxing commission wouldn't allow that fight in the state of New York. Despite the fact that Willard protested he was in the pink of condition and thought he was never so fit in his life, the commission knew he was

With His Head Protected by a Mask, to Guard against Cauliflower Ears, Dempsey Spars with Jack Petty

forty. "Too old," they said. The fight was barred there.

Georges Carpentier was another great heavy-weight who never recovered his bearings after having been knocked out. Dempsey flung him into limbo after that "Battle of the Century," at Boyle's Thirty Acres, in 1921. Carpentier lasted four rounds. He tried feebly to come back, but another defeat at the hands of Tunney, in 1924, sent him to seclusion in his own land.

But Dempsey was blind to the fates of his predecessors and his victims. He never stopped to think what had brought their downfall. So, from 1921 to 1923, he sat back idly upon his throne. He had made a fortune. The lull in his career was interrupted by Firpo, whom he defeated in September, 1923, in two rounds, but not until after he had been floored and knocked out of the ring himself in the first round. Nobody ever dreamed that, three years later, Dempsey himself would go down to defeat at the hands of Gene Tunney. That overthrow bit deep into his heart. As he gazed into a mirror and looked at his swollen face after the fight, he said, "I will be repaid for that."

You recall how he withdrew six months ago into the recesses of the Ventura mountains in California and began his come-back grind. I'm sure that to him it meant more than to other champions of the past who tried to retread their way to the throne. He surveyed the list of those who had tried to recover their crown and found that Stanley Ketchel, whose middle-weight title had been lifted from his brow by Billie Papke, was the only one to come back and beat the same man who had previously dethroned him.

Dempsey worked like a blue devil, and last July he finished the first leg of his come-back stunt when he knocked out Jack Sharkey. In this fight he showed himself to be his former self, not a shadow or ghost, but more like the Dempsey who could mow down Willards and Firpos.

What was it that lured Dempsey and other champions back to the throne? Was it the glitter of gold? Was it the plaudits of the multitudes? What was it?

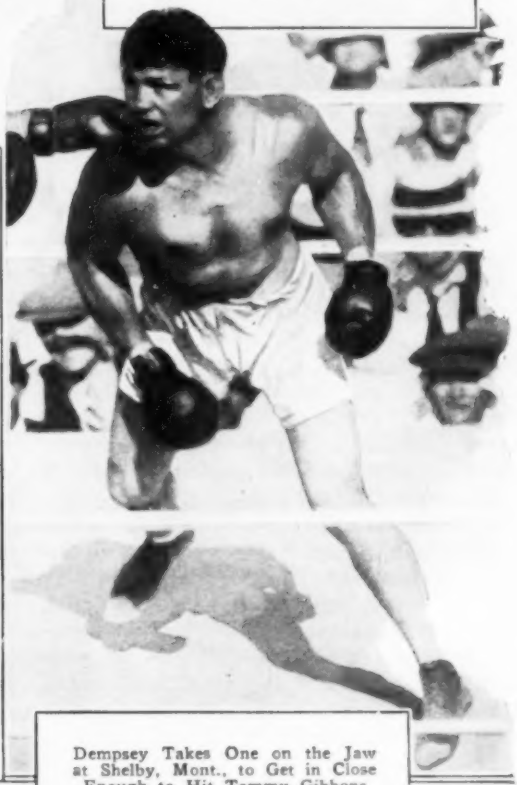
Mercenary men will say it was the big purses. Adventurers with romantic minds will say it was the love of the game. Psychologists will say it is something innate in man to crave the spotlight and to bask in its glare.

These allurements exist today. They did not prevail in bare-knuckle days of two centuries ago. In the "fair, stand-up-fight days" of Figg and Mendoza, things

Dempsey and Jerry the Greek in a Tug of War at Saratoga Springs

Dempsey Punching the Bag at Atlantic City Before He Lost His Title to Gene Tunney

Quintin Romero-Rojas, Chilean Fighter, Using a Bicycle as a Training Machine



Dempsey Takes One on the Jaw at Shelby, Mont., to Get in Close Enough to Hit Tommy Gibbons

Dempsey in Training Camp Before He Eliminated Sharkey as a Heavy-Weight Contender; Jerry the Greek, the Trainer of Dempsey in Recent Years, Is Removing the Gloves after a Workout

were different. Ring mechanics and science were different. Purses were different. There was little glory. Those were gory battles for purses which hardly ever exceeded $25,000 and usually were around $500.

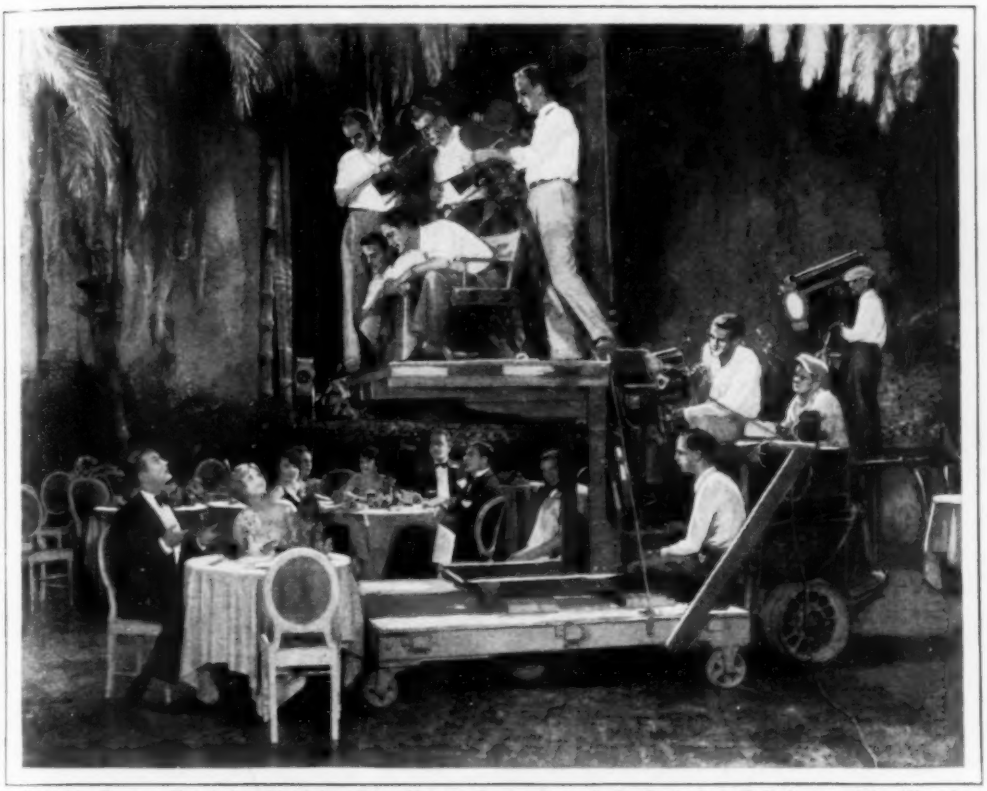
The evolution of prize fighting in the professional sense has wrought a multitude of changes. The brutally sanguinary aspects of the fight have been eliminated. It is a genuine sport today, no more dangerous than football and, so far as accidents go, no more harmful than tennis. Boxing today is a fully developed science. The fighter is part of an organization, a vast scheme.

There are weeks of systematic training. Every movement of the boxer before a championship fight is carefully supervised. No detail is overlooked. Trainers get their boxers to an acme of physical perfection. The ancient Athenians would gasp in astonishment if they could gaze upon the physique of the modern prize fighter. He would make a fine subject for the greatest of sculptures.

So, after weeks of grueling training, the fighter is ready for battle. It is no longer a battle between men of far-divergent ages. It is a battle between youth. In the old days when a prize fight was sheer overwhelming by brute force, a man of forty or fifty might have vanquished a lad in his late teens or twenties. But not today. Now it is a battle of technique. Knowing how to hit. Hitting hard and effectively. Stamina are needed.

The large purses of modern times are sufficient inducement for most fighters to attempt a come-back. When Dempsey knocked out Firpo, he received $750,000 for exactly three minutes and fifty-seven seconds of actual fighting. On the other hand, the big purse is not always the fundamental element which figures in a come-back try. The psychological effects of defeat often force a fighter to retire straightway from the ring. He feels himself shamed before the world that worshiped him. Freddy Welsh never got over the defeat he suffered at the hands of Benny Leonard.

But this fellow Dempsey, who cannot be considered an old man at thirty-two, liked the glamor of victory as well as its fruits. Candidly, as I know Dempsey, I think that it was the glory that lured him back into the ring more than the money he might make there.



Portable Camera Truck for Obtaining Close-Ups on Large Sets; It Is Pushed or Pulled around by Electric Unit, and the Platform Can Be Raised or Lowered

CAMERA TRUCK HAS LIFT CRANE FOR MOVIE "SHOTS"

Saving the time and expense of arranging a number of separate groupings, an electrically operated truck can be steered about on the motion-picture set, enabling the photographer to take closer views from almost any angle. A feature of the apparatus, as adapted at one Hollywood studio, was the lift platform on the truck on which the director and cameramen could be raised for "shots" looking down on different groups.

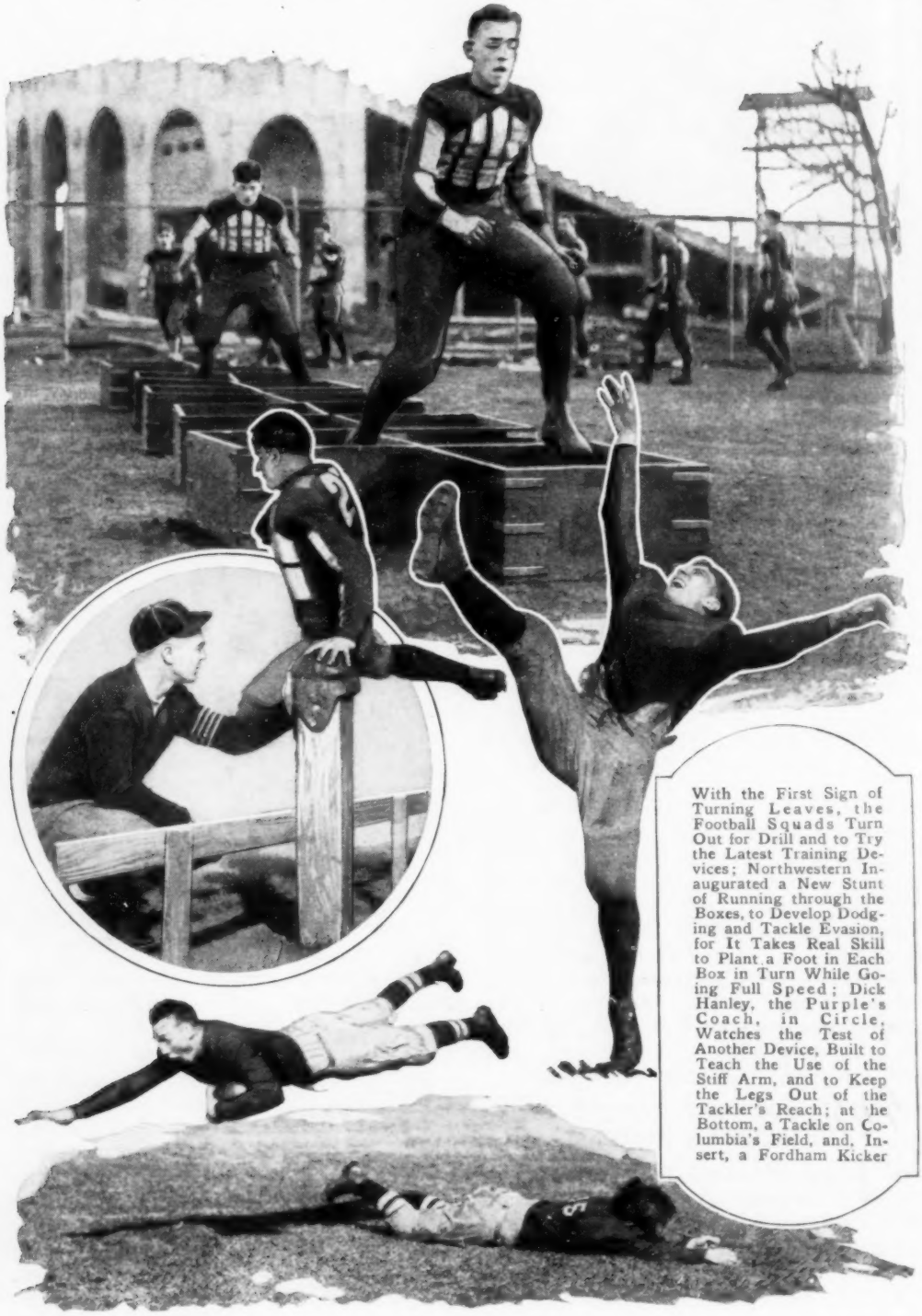
FISH CAUGHT BY ELECTRICITY IN GERMAN STREAM

Fishing with electricity has been introduced in Germany. A restricted section of a stream is subjected to a heavy electrical charge which stuns the fish so that they rise to the surface and are captured. Pike and other enemies to fish of more desirable kinds are killed, the marketable varieties are retained and undersized ones returned at once to the water, where they revive. While the method has been successful, it is suggested that stringent rules be made governing its practice to prevent too rapid exhaustion of supplies.

SPECTACLES WITH MIRRORS AFFORD REAR VIEW

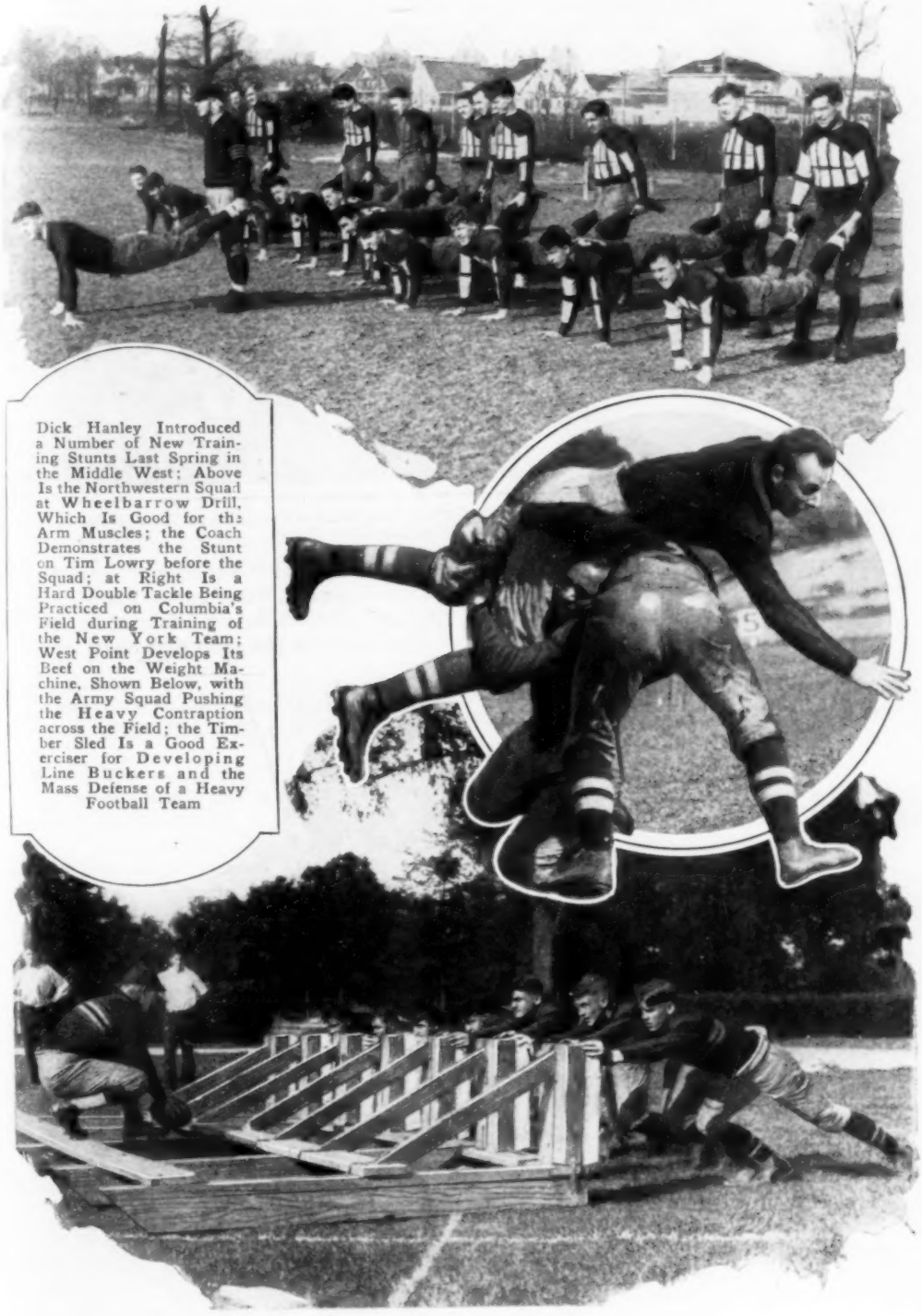
Designed especially for the automobile driver, a pair of very wide-rimmed glasses, now on the market, has a small mirror on each side so that the wearer can see the road behind him. The reflectors do not interfere with the vision ahead and are backed by material like that of the frame.

BUILDING BEEF AND BRAWN FOR THE CLASHES



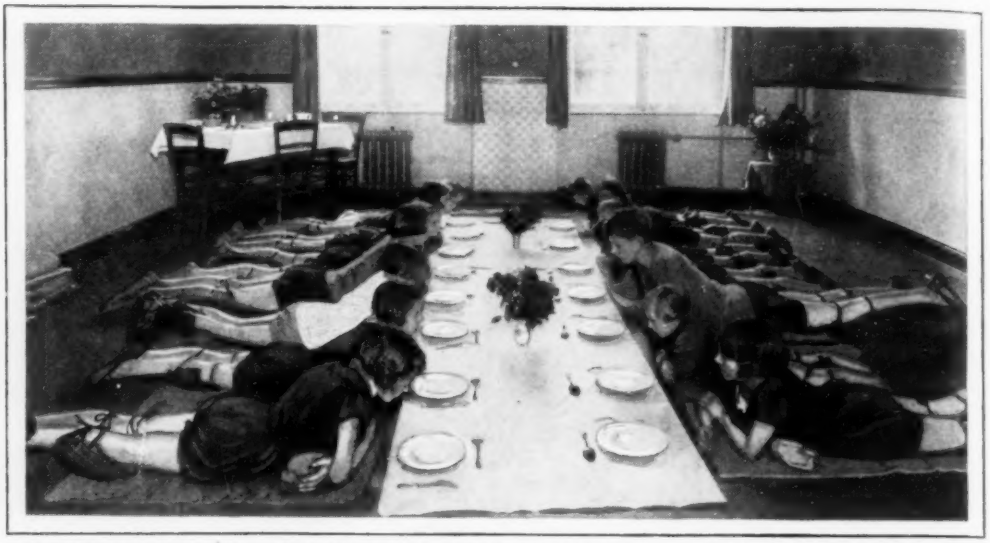
With the First Sign of Turning Leaves, the Football Squads Turn Out for Drill and to Try the Latest Training Devices; Northwestern Inaugurated a New Stunt of Running through the Boxes, to Develop Dodging and Tackle Evasion, for It Takes Real Skill to Plant a Foot in Each Box in Turn While Going Full Speed; Dick Hanley, the Purple's Coach, in Circle, Watches the Test of Another Device, Built to Teach the Use of the Stiff Arm, and to Keep the Legs Out of the Tackler's Reach; at the Bottom, a Tackle on Columbia's Field, and, Insert, a Fordham Kicker

THAT DRAW MILLIONS TO COLLEGE STADIUMS



Dick Hanley Introduced a Number of New Training Stunts Last Spring in the Middle West; Above Is the Northwestern Squad at Wheelbarrow Drill, Which Is Good for the Arm Muscles; the Coach Demonstrates the Stunt on Tim Lowry before the Squad; at Right Is a Hard Double Tackle Being Practiced on Columbia's Field during Training of the New York Team; West Point Develops Its Beef on the Weight Machine, Shown Below, with the Army Squad Pushing the Heavy Contraption across the Field; the Timber Sled Is a Good Exerciser for Developing Line Buckers and the Mass Defense of a Heavy Football Team

CREEPING HELPS STRENGTHEN CHILDREN'S SPINES



Meal Time for the Creeping Class; These Children in German Hospital Are Forbidden to Walk While Taking Special Treatments to Strengthen Their Spines

Children with weak spines at a German hospital are taught to creep instead of walk, so that there will be less weight on the backbone and undue strains will be removed. Knees, feet and elbows are guarded with special protectors. They lie prone at their meals. It is said that many cures have been effected by this system.

TOWING CAR LIKE LOCOMOTIVE ADVERTISES SHOP

Built in the form of a locomotive, an automobile-wrecking car in Portland, Ore., has a bell and air whistle, the exhaust of the motor passes out by the smokestack, and the tender conceals most of the crane and other apparatus when not in use. Besides being efficient, the outfit helps advertise the shop that operates it.

Auto-Wrecking Car like Locomotive; Fumes from the Exhaust Are Passed through the Smokestack

NEW BRIDGE WORLD'S BIGGEST STEEL STRUCTURE

Calling for bids for the new Hudson river suspension bridge, to link New York city with the New Jersey shore, recently revealed that the bridge was the biggest steel structural contract ever let. The plans call for approximately 150,000 tons of steel. The main span will be 3,500 feet in length, as compared with the present world's biggest suspension bridge, the new Philadelphia-Camden link, which has a span of 1,750 feet. The Brooklyn bridge, on the other side of New York city from the new structure, has a 1,600-foot span. Total cost of the Hudson river bridge is estimated at $75,000,000, and it will carry eight traffic lanes for vehicles on the upper deck and four tracks for

street cars on the lower. Despite the huge size, the plans have been drawn in such a way as to utilize standard structural parts, requiring no new equipment in the shops to fabricate them. Each of the masonry towers at the ends of the main span will be reinforced inside with sixteen steel towers, all made up of structural members forming a six-foot square box. Bids were sought on two types of bridges, one made up of wire cables, as used in the Delaware river, Brooklyn, Manhattan and Williamsburg bridges, and the other of heat-treated eye bars, pinned together at the ends, as used in the St. Lawrence, Queensboro and Memphis bridges. If wire cables are used, there will be four of them, three feet in diameter, and each containing 26,474 wires. The present biggest bridge at Philadelphia has four thirty-inch cables of 18,666 wires each. The biggest eye-bar bridge, over the St. Lawrence, has thirty-two chains of bars, each sixteen by two and three-sixteenths inches, with a strength of 80,000 pounds per square inch.

FACE BATH OF LIGHT AND VAPOR LATEST BEAUTY AID

For facial treatments, French beauty experts have introduced a cabinet that gives light and vapor baths. The steam is said to open the pores, while blue rays from the special lamps stimulate the circulation. The outfit is compactly constructed and permits the subject to remain comfortably seated while the face is being treated.

Light and Steam Face Treatment at Beauty Parlor; an Advantage Is That the Hair Is Not Disturbed

Reel Extended, Showing the Projecting Arms and Screw for Attaching It to Wall

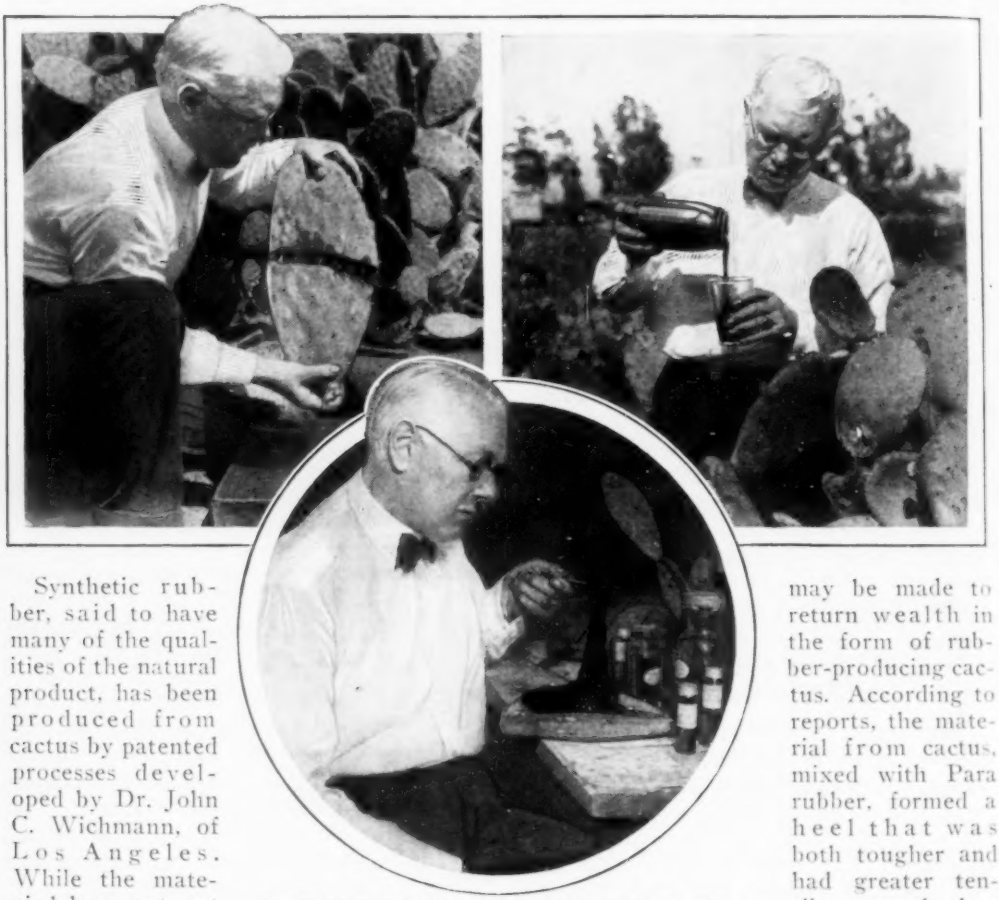
FOLDING REEL TO DRY FISHLINE SAVES ROT AND TROUBLE

Drying the fishing line is easily done on a folding aluminum reel that fits in almost any tackle box. It has three extension arms that collapse flat for packing, and are quickly made ready for holding the line by adjusting a knurled nut. The reel may be screwed into any convenient place for use, takes line of any length and enables easy rewinding of the rod reel.

FIRST SPEEDOMETER ON WAGON EARLY RECORDS SHOW

Speedometers are commonly believed to have appeared at the beginning of the bicycle and automobile age, but early historical records indicate that the idea originated with one of the Mormon immigrants on their way by wagon caravan to Utah. The travelers had no way of determining how far they had gone each day until William Clayton, in charge of one of the vehicles, measured off a mile, then counted the number of revolutions the wheel required to traverse the distance. He devised a ratchet that moved a cogwheel apparatus to record the revolutions automatically and so obtained a speedometer similar to the modern instrument.

RUBBER FROM CACTUS PROMISES LOWER TIRE COST



Dr. Wichmann Pulling Cactus Lobe Apart, to Show the Sticky Sap, and Steps in Making the Substitute

Synthetic rubber, said to have many of the qualities of the natural product, has been produced from cactus by patented processes developed by Dr. John C. Wichmann, of Los Angeles. While the material has not yet been tested in auto tires or tubes, it promises to be so satisfactory a substitute for other rubber articles, that more pure rubber will be available for tire purposes, thus making possible a reduction in prices. "Rubber" already has been produced from potatoes, cabbages, bananas, milkweed and other plants, but production costs have been too great to justify commercial application of the processes. An advantageous feature of the cactus is that only the lobes of the plant are used, leaving the stalk to produce more the following season, and the best rubber substitute seems to have been made from the cactus that grows wild on the unwatered plains, indicating that special cultivation will not be necessary and that thousands of acres of land, now yielding nothing in the way of crops, may be made to return wealth in the form of rubber-producing cactus. According to reports, the material from cactus, mixed with Para rubber, formed a heel that was both tougher and had greater tensile strength than the ordinary variety. The cactus rubber gum, mixed with benzole, formed a cement with exceptionally good adhesive qualities. Mats with a base of the cactus rubber were tougher than those of Para rubber, the inventor reported, and he found that it could be "loaded" with other materials for the manufacture of various articles without the danger of crumbling. Pure Para rubber curdles if too much foreign substance is introduced, but the cactus product is said to hold far larger quantities of added materials. Besides rubber, the cactus yields a varnish, a lacquer, cow fodder and a pulp for making paper. To obtain the products, the cactus lobes are crushed, and cooked half an hour at 240 degrees to extract the gummy liquid. This is then treated until the rubber is formed.

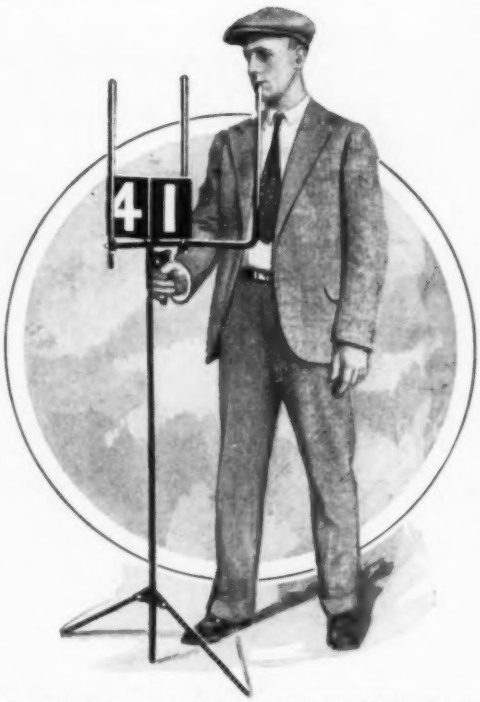
WILD CREATURES DIE EARLY ANIMAL "CENSUS" SHOWS

Few wild animals live out the span of their natural life, and the reasons some species attain so much greater longevity than others are not altogether clear to students. From data collected by naturalists, a fairly reliable "life-expectancy" table has been compiled for a large number of animals. It reveals several points not generally realized; for instance, that earth worms may linger for ten years or more, some kinds of ants have lived in captivity for ten to fifteen years and, though the queen bee is engaged in the almost constant production of eggs, it lives for four or five years, while the average life span of the busy workers is not over six weeks. Elephants sometimes live to be 200 years old; tortoises, especially the giant species, to 300; carp and pike may reach 150. Among birds, the crane has a life expectancy of forty to fifty years; the heron sixty; the owl sixty-eight; doves, ostriches and woodpeckers, sixty to seventy. Domestic fowls may live to be twenty years old; sheep ten to fifteen; dogs and wolves, ten to fifteen, and cats nine to ten. Canaries attain the age of twenty and more; mice commonly live three or four years, and horses may reach forty or fifty. Fresh-water pearl mussels may live to be sixty or seventy years old, and crabs over twenty.

DOG WINS FIVE FIRST PRIZES AT ENGLISH SHOW

"The Jockey," a French poodle, was awarded five first-place ribbons at a recent show in London against a number of high-class competitors. These dogs are believed to have been developed from the spaniels and are characterized by their extremely long, curly hair, intelligence and vivacity. They are favorites among circus trainers. Dogs are judged on forty or more points.

Winner of Five First Prizes, the Long-Haired French Poodle



Football Meter with Sights for Quickly Lining Up the Ball, to Gauge Its Position on Field

METER TO LOCATE FOOTBALL SAVES LINEMEN'S TIME

Determining the exact location of the football on the field after a play is sometimes a difficult task, especially when the side lines are obliterated by snow or water, but this task is now simple with the aid of a special meter which has just been introduced. It is essentially a sighting device with two legs resting on the side lines to form right angles with the sights above. With the meter in the proper position on the line, it is moved along until the tip of the ball is in alinement with the sights. If the side marks are obscured, correct checking is made with the aid of two stakes which are placed parallel to the side line at one end of the field. The "gridometer" is the invention of two Iowa men.

Hunting BIRDS

Jet-Black Bird of Paradise with Green Top Knot and Breast and the Two Long Quill-Like Feathers Growing from the Head; This Is a Newly Discovered Species

By HAROLD T. WILKINS

DEEP in the fastnesses of woods in the cannibal islands of the South seas, collectors daily risk their lives to supply something new and more lovely in millinery. The hunter runs the double hazard of death at the hands of unseen savages of the stone age, who shoot poisoned arrows from dense thickets, and of ruined health from deadly fevers contracted in wading through tropic swamps, where stinging insects try to keep him back from the remote haunts of the gorgeous bird of paradise.

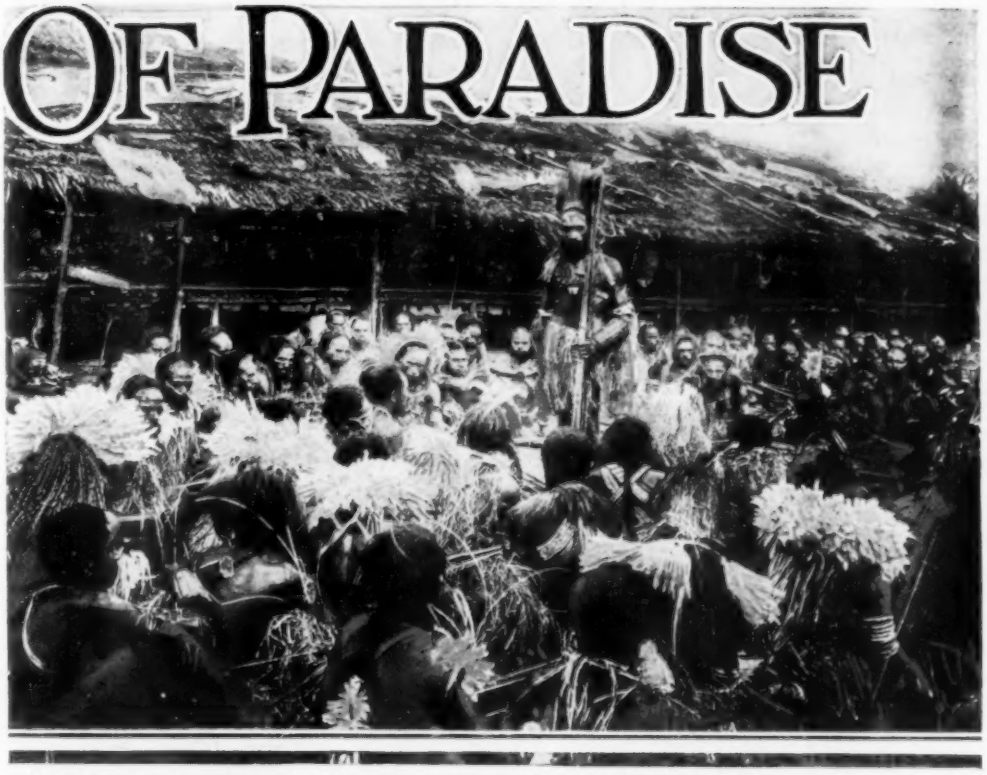
Around this El Dorado of the tropical bird world, legends have clustered thickly. The old Dutch East India travelers said these brilliant birds had neither wings nor feet, and passed their lives in air, hanging by their wire tail feathers from the top branches of some lofty tree where they fed on the nectar of flowers.

The hunter of the bird of paradise plunges into the tangled bush of gloom and darkness about April to reach the far-away New Guinea mountains about May, when the male bird whirls in a magnificent golden-fan dance, surrounded by admiring mates in brown plumage in the tree tops.

The high prices put on the lovely plumes have led the native hunter to kill the birds in a reckless manner. The Papuans sell the skins to traders who give them opium in exchange. The lure of this drug led to the practical extinction of the beautiful blue "Rudolphi" bird of paradise, which haunts the coast regions, and now the hunter has to go far inland to reach the remote forest-clad mountains where other lovely species of these birds live and dance.

In New Guinea, the birds are a monopoly of the chiefs of the coast tribes, who buy them cheaply of the mountain Papuans. The white or yellow trader, or the scientist who collects the birds for American and British museums, enlists his carriers from the tribes of the lowlands. It is not easy to get native carriers on an adventurous trip into the in-

OF PARADISE



Cannibals of the Aru Islands in the South Seas, Decked Out in Headdresses of Priceless Feathers from the King Bird of Paradise, Worn in the Annual Harvest Ceremonies

terior, because of their fear of the mountaineers, who are cannibals and the deadly enemies of the Papuans of the plains.

The first stage of the journey is by river steamer, 150 miles up country. Then the white collector embarks on a launch and steams for two days upstream to where canoes will ferry him to the foot of the mountains. Hundreds of portages around rapids will have to be passed, and many days will be spent going around these rapids, on an ascent, which, on the return, will be done in six hours.

Way back on the mountains, the loveliest specimens of the birds of paradise will be found. At night, a cold, damp mist comes up from the ground, and the trees and shrubs drip wet. The atmosphere is that of a London fog, and you are back in the stone age among natives armed with stone adzes, and bows and arrows. Dense forests are all around, and dangerous precipices overlook swamps infested by giant mosquitoes.

Each of the seventy-eight or so known species of the birds of paradise, enumerated by the English collector, Lord Rothschild, lives in a restricted area, and all of them have each a definite locality. When the mating season comes, in early summer, the male birds dance on trees with great spreading tops. The hidden watcher below on the dark forest floor, looks up through the branches to witness a wonderful spectacle.

A dozen birds, in full plumage, stretch out their wings, forming two golden fans, deep-red at the base and fading to pale-brown at the finely tufted wing tips.

The birds keep their wings stretched out horizontally, and the neck and beak bent around, while the long plumes are erected into a graceful tuft on each side above the wings In this attitude they dance up and down, entirely oblivious to all danger

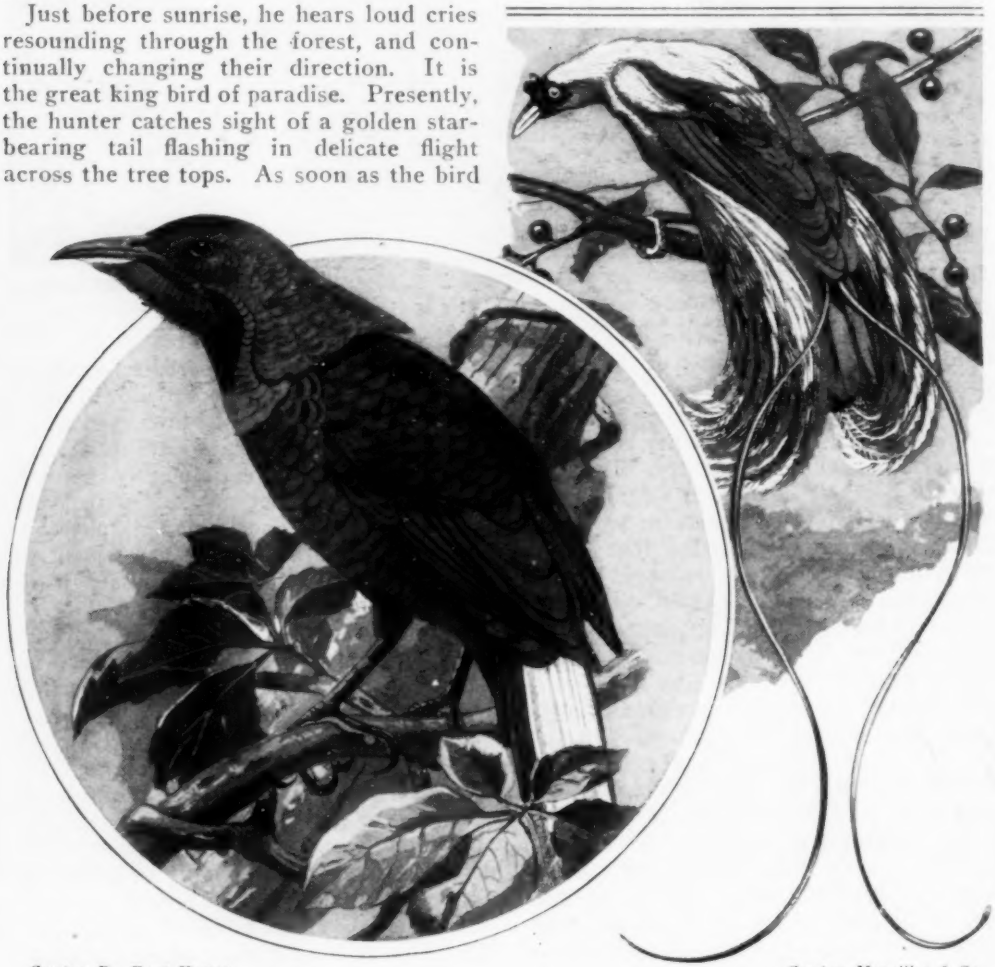
A Papuan boy, standing at the base of the tall trees, shoots bird after bird, collecting them as they fall through the branches. The methods used by the na-

tives to kill or snare these birds are most ingenious. The great object of the native hunter is, of course, to prevent any possible damage to the plumage.

The lonely Aru islands, 250 miles west of Dutch New Guinea, are the home of several beautiful species of birds of paradise. Here, about a dozen men, women and children occupy a shed in a clearing of a village in a swamp, which the trader reaches by canoe. The native hunters of the birds live in the jungle outside the village. A hunter builds a lofty hut in the branches of trees known to be frequented by the birds. At dawn, he climbs up into the fork of the tree to wait hidden behind a shelter of cunningly woven branches and thatch.

Just before sunrise, he hears loud cries resounding through the forest, and continually changing their direction. It is the great king bird of paradise. Presently, the hunter catches sight of a golden star-bearing tail flashing in delicate flight across the tree tops. As soon as the bird perches on the tree tops to peck at the red fruit it loves, the hidden hunter lets fly with a blunt-headed arrow, topped with a conical woven cap, which stuns the bird but does not pierce its flesh.

Off the coast of New Guinea is the little Waigiou island, the only home of the red bird of paradise, which the natives catch in a very clever way. They know these wonderful birds are very fond of a scarlet fruit. So the hunters fasten this fruit to a stout forked stick, and, providing themselves with a fine strong cord, seek out a tree in the forest on which the birds perch. They climb up by hitching the stick to a branch, and then arrange the cord in a noose so ingeniously that



Courtesy Dr. Ernst Hartert — Courtesy Macmillan & Co.

Newly Discovered Paradise Bird That Rivals the Peacock in the Brilliance of Its Green, Red, Blue and Purple Feathers; Above, the Red Bird of Paradise in Full Courting Plumage

when the bird flies down to eat the fruit, its legs are caught, and by pulling on the end of the cord, which hangs down to the ground, the bird is trapped.

Organized drives on the birds are arranged by the natives, who pick out a likely-looking place on the saddle of the spur of a mountain and then cut a lane leading from it through the trees of the forest. The birds are then left to get accustomed to this road through the trees. One day, great nets are set up at the end of the lane, and shouting and whooping, the natives drive the birds down the cutting through the trees, until they are beaten into the funnel-shaped nets.

The eggs of the birds of paradise, with their strange markings, are a rare and coveted prize for the ornithologist and the museums. Fuzzy-headed natives say the bird of paradise nests in an anthill, and never lays more than one egg.

Lord Rothschild, of England, has the world's biggest collection of skins of birds of paradise housed in the galleries of the famous zoological museum at Tring, Hertfordshire. Many of the finest skins have been acquired from traders in the heart of British and Dutch New Guinea.

Courtesy Macmillan & Co.

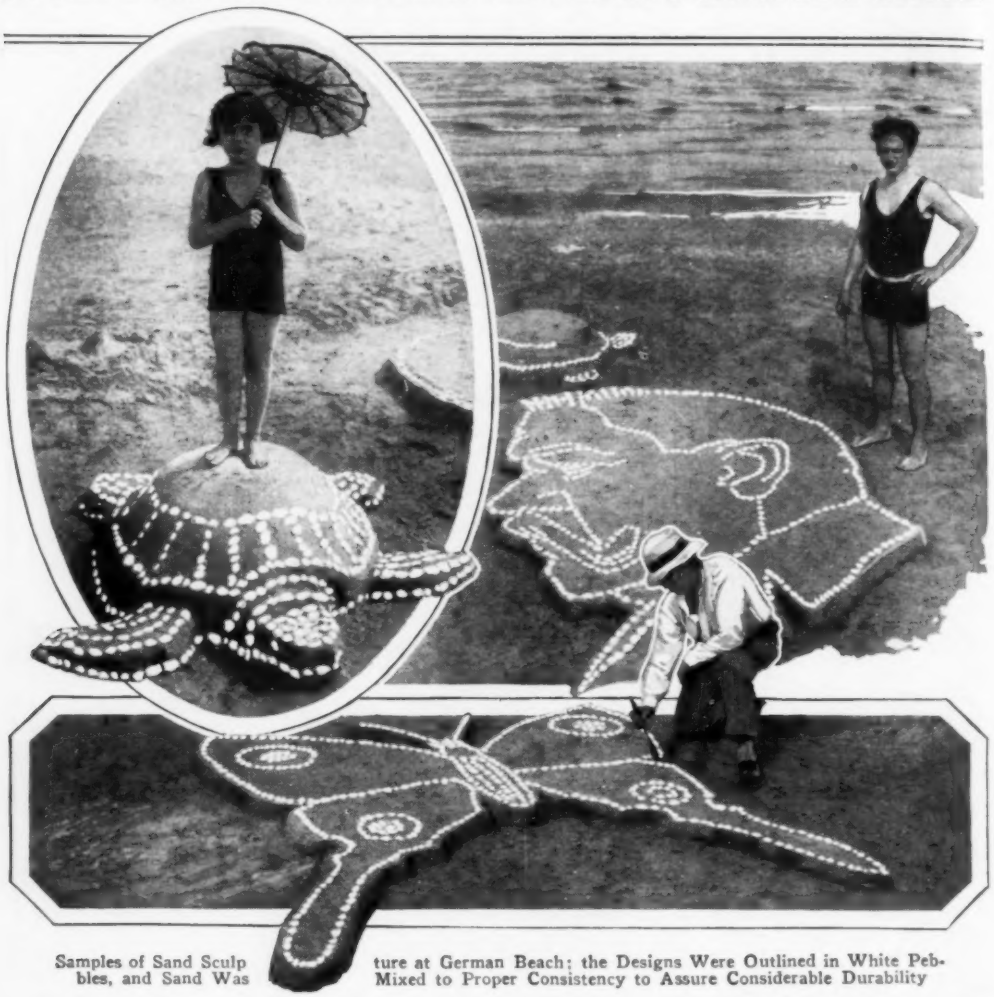
Aru Native, Hidden in a Tree Fork beneath a Thatch Blind, Shooting King Birds of Paradise with a Blunt-Tipped Arrow

SPIRAL STEM FOR OIL-WELL BIT INSURES A STRAIGHT HOLE

One of the difficulties in drilling oil wells is that when the bit strikes a formation that is harder on one side than on the other, it glances off to the soft side, making a crooked hole. An improved spiral stem, or drilling connection between the cable and the bit, fills the hole and is said to force the bit to cut straight through all obstructions, making a vertical hole. An additional feature is that a spiral groove provides ample passageway for water and aids in mixing the mud thoroughly, so that it may readily be bailed out. The unit is not designed for the purpose of straightening crooked or flat holes, but to prevent these troubles.

¶Music of the tree crickets is produced by the insect drawing the right fore wing across the left.

SCULPTURE AT BEACHES DEVELOPS ARTIST'S SKILL



Samples of Sand Sculpture at German Beach; the Designs Were Outlined in White Pebbles, and Sand Was Mixed to Proper Consistency to Assure Considerable Durability

With a little care and patience, remarkably accurate figures can be made from beach sand, moistened to the proper consistency and not allowed to dry too soon. The turtle shown here was strong enough to carry the child's weight, and more elaborate representations are made with the help of a skeleton support. Addition of pebbles to the designs proved an effective way of outlining the figures.

USE CAMERA IN WOOD GRAINING INSTEAD OF BRUSH

To keep pace with the constantly growing demand for the reproduction of wood graining on metal furniture and other articles, the camera has been pressed into service to supplant the slower and more costly hand methods. A plate, thirty by eighty-seven inches in size, is employed to photograph various hardwood finishes. The pattern is then etched on a copper plate and over it is smeared a graining compound of the consistency of printers' ink. An impression of the grain is taken from the plate on specially prepared composition rolls which are used to transfer the pattern on the surface, already painted the color of the wood that is to be imitated. Another drying follows the transfer, and the article is placed in a ventilating booth and sprayed under pressure with lacquer or varnish which is finally baked on. The

photographic process is used also in copying marble patterns on slate and other materials for soda-fountain and similar installations.

RADIO PHOTOGRAPHS CONVEY NAVY ORDERS

Successful tests in sending photographs of written orders by radio instead of by dot-and-dash messages, have been completed between the U. S. S. "Seattle" and the navy department in Washington, indicating the possibility of this form of communication for greater accuracy and secrecy. There are three obstacles to the immediate adoption of the method on a large scale, however. The receiving and sending apparatus costs $13,000, the equipment is bulky and a message covering a relatively small space requires an hour to send.

GAS IS CARRIED IN FLAT PIPES ACROSS AUTO ROAD

How to install a gas main between the top of a subway and the street paving above proved a problem in Cincinnati recently, as there was only a foot of vertical space available and sixteen-inch pipe was being used. A solution was reached in a pair of flat, box-shaped steel conduits, requiring but a few inches of depth. They were placed on the concrete roof of the subway and connected to the ground mains.

Flat Gas Pipe and Its Connection with the Main Conduit at Point of Crossing under Pavement

Gauging Approximate Distance of Bus Routes with the Measuring Wheel; Meter at Top Records Mileage, Saving More Elaborate Survey on Curves

WHEEL THAT MEASURES MILES GAUGES BUS ROUTES

Bus-route distances are calculated in a foreign city with the aid of a hand-propelled wheel that carries a special speedometer to register the miles. One man runs the wheel while another notes down the distances between points. The device is especially helpful in computing the mileage of proposed routes with many curves.

TRAP MOTHS BY ELECTRICITY TO PROTECT TOMATOES

Killing moths with electricity and kerosene has been successful on a truck farm near Danville, Va. The gardens are wired for electric lights to attract the tomato-worm moths and, as they fly close to the bulbs, they fall into pans of kerosene placed below the lamps. Before this trapping method was adopted, approximately half of the crop was lost. The farm owner estimates that a saving of from $2,000 to $4,000 has been realized yearly.

Type of Gas-Electric Light Devised for Landing-Field Beacon as Special Aid in Fogs; the Rays Have Far Greater Mist Penetration than Those of Ordinary Lights

PINKISH GLOW OF VAPOR LIGHT TO CONQUER FOGS

More effective aid for aviators while landing in fogs is promised in a beacon light being developed by eastern engineers. It is a neon-gas type of lamp, affording illumination through the glow of the vapor rather than by a filament, and the pinkish color of the light is said to be much more successful in penetrating fogs and mists.

JOB THAT NEVER ENDS

It takes three years for the steeple-jack painters to cover the bridge over the Firth of Forth and, when they have completed it once, it is time to begin all over. Many of the men now working on it have been engaged since 1890, when the bridge was opened. It is approximately four miles long and principally of steel, the area to be covered with paint being the equivalent of 135 acres. During the operation, trains are crossing every five or ten minutes, and a motor launch constantly patrols the waters beneath, to rescue any man who might fall.

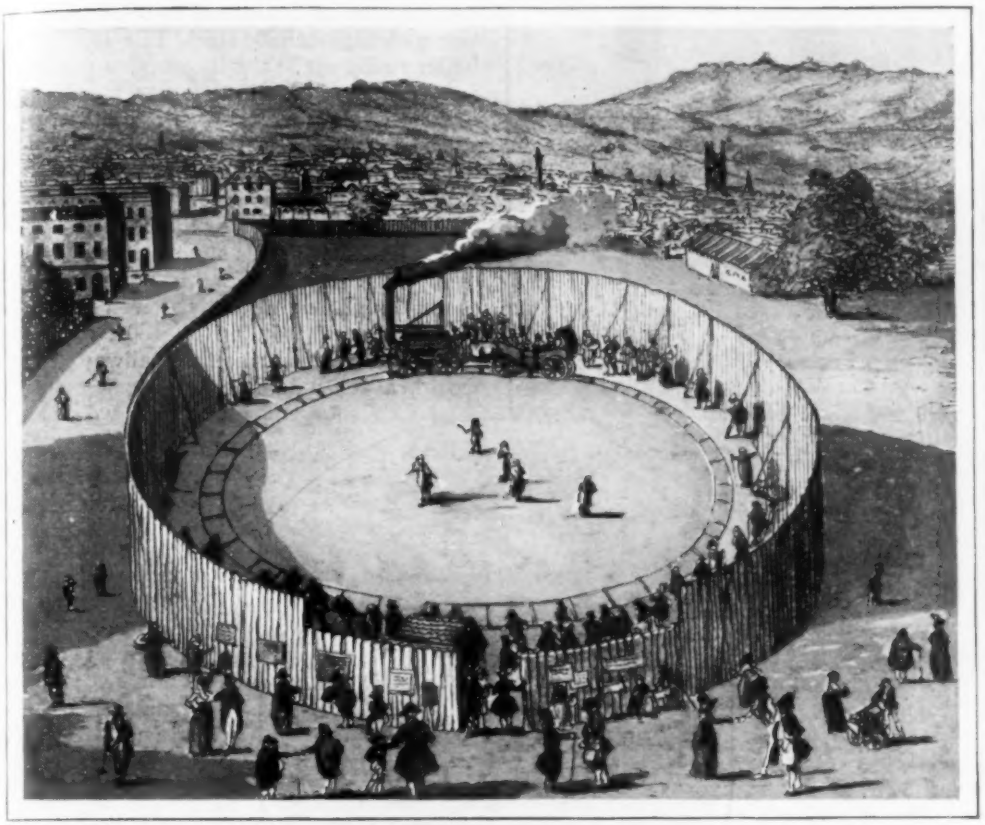
NEW INDUSTRY FROM SEAWEED DEVELOPED IN CALIFORNIA

Agar, a substance long used in medicine and in chemistry and now coming into demand as an auxiliary food product, is being produced from seaweed along the California coast, the industry promising a source of revenue to gatherers of the weed and freeing the United States from dependence on Japan for supplies of the material. The seaweed is dried in the open air, washed in wooden tanks and forked into wire baskets. A six-hour treatment and other processes follow, which yield the dried gelatinous extract. The product is sacked for shipment and is said to be superior to imported varieties as it contains fewer bacteria, is more uniform in quality and absorbs more water, a characteristic which makes it useful in various industries.

TOADSTOOL GARDEN CANOPY IS NOVEL DECORATION

From the trunk of an old tree, some lumber, sheet metal and stucco, an Ohio man has fashioned a novel canopy for his garden. It is shaped in the form of a giant toadstool, ten feet high and sixteen feet across. Below is a brick floor and marble benches, arranged for serving tea.

Toadstool Shelter over Garden Seats, Formed from the Trunk of an Old Tree, Lumber, Sheet Metal and Stucco



Old Sketch of the First Steam Locomotive to Haul Passengers for Pay Traveling on a Circular Track, inside a Stockade in London, Where an Enterprising Showman Earned Big Profits

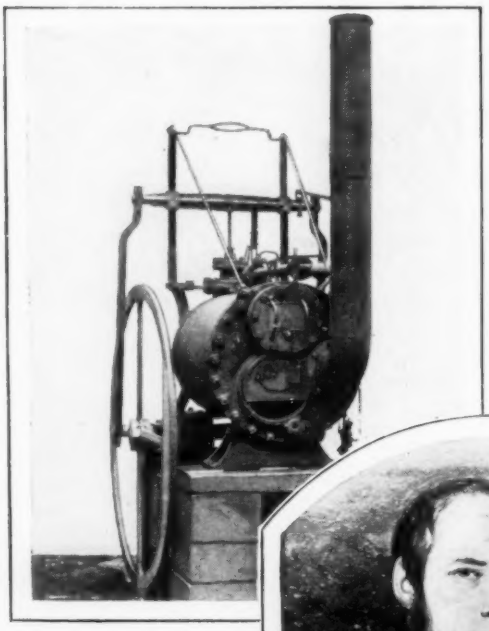
The Romance of Steam Power

Pioneers Who Put Boiling Water to Work in Factory, Mine and on Rails Had Continuous Battle with Poverty

THE recent centenary of the death of Samuel Crompton at Bolton, Lancashire, Eng., where he did the experimental work on his spinning "mule" and revolutionized the cotton industry of the world, recalled, in its observance, the romance of the sudden rise of steam power, within a few years at the end of the eighteenth and beginning of the nineteenth century.

All of the names that are associated with the application of steam to work in factories, mines and on rails for transportation, also are associated with battles against poverty and the general apathy of the public. They include Edmund Cartwright, inventor of the loom in 1787; Arkwright, who produced the spinning frame in 1769; the "spinning jenny" of Hargreaves, invented in 1770; John Kay's fly shuttle in 1773; the Jacquard loom of 1806 and Crompton's mule, which he perfected in 1779. Like most inventors, he made little out of the invention, and, though he lived for forty-eight years after it was introduced and saw others make fortunes from it, he died at Bolton in abject poverty.

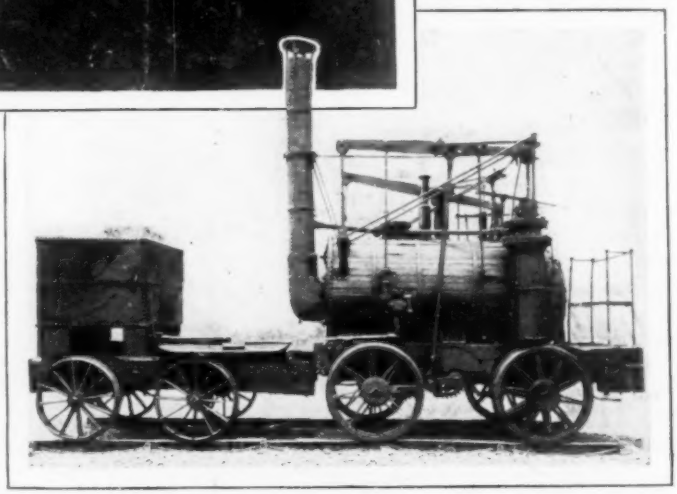
While these inventors were revolutionizing the textile industry for steam-power production, others were at work on transportation. James Watt's first condensing steam engine became a success about 1776, and then, just before 1800, Richard Trevithick, of Cornwall, evolved the high-



pressure boiler. Trevithick, though his name is almost unheard outside engineering circles, may be regarded as one of the greatest engineers of all time. Like his father before him, he was chief engineer at a famous tin mine in Cornwall. He realized that the future of the steam engine depended on increasing the pressure to get more power for a given weight of engine. Watt insisted on five or six pounds' pressure, and even tried to get a law through parliament forbidding the use of higher pressures as dangerous.

Trevithick, however, turned out the original of all "Cornish" boilers when he built one to operate on more than twenty pounds to the square inch—a very modest pressure as compared to modern practice with high-tensile steel. The Trevithick boiler really made the locomotive possible, for with its invention it was feasible to develop the necessary power without an excessive weight. He realized that, and at once started building a model locomotive. On Christmas Eve, in 1801, he tried out a large locomotive which he had had built in a blacksmith's shop, and succeeded in driving it up a hill and back again. Another of his engines was driven through the streets of London in 1804, and the same year he built the first railway in the world, a ten-mile line serving a colliery at Penydaran, Wales. The engine could drag the train of small coal cars, really wagons on flanged wheels, at four miles an hour.

The same year another of his locomotives was sent to the northeast coast of England for the Wylan colliery, where it was modified and improved by Hackworth, Hedley, Blenkinsop and Foster. Hedley, in 1816, constructed the famous "Puff-



At the Top Is Shown Trevithick's First High-Pressure "Cornish" Boiler and in the Center, the Inventor, from an Oil Painting in South Kensington Museum; at the Bottom, "Puffing Billy," Built by Hedley in 1816

ing Billy," now preserved in the South Kensington museum.

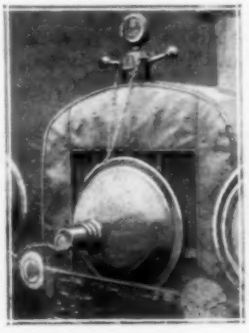
Although George Stephenson is popularly given the credit for inventing the locomotive, there were dozens in operation on short colliery roads before the Stockton and Darlington railroad opened, in 1825, with his "Locomotion No. 1" as the motive power. What Stephenson did do was building the first engine used to haul passengers, but the locomotive itself was a mixture of Blenkinsop and Hedley's designs, and contained all of Trevithick's original inventions, including the Cornish boiler, gauge glass to show water level, use of the exhaust steam in the flue, and the flanged rails on which it ran.

Trevithick had exhibited a large engine in London in 1809. He called it the "Catch-me-who-can," and showed it on a circular track inclosed behind a high board fence, charging admission to see it and a shilling a ride for a trip in the carriage which it drew. Stephenson's passenger train was the first to travel between two given points, but Trevithick's circular road was probably the first to receive pay for rides.

Like Crompton, Trevithick made little out of his inventions, and died in poverty. Besides his work on the locomotive, he invented the first steam dredge, the first steam-driven threshing machine, and was the first to try to tunnel under the Thames, nearly losing his life in the attempt.

LAMP TO HEAT AUTO RADIATOR PREVENTS CAR FREEZING

Attachable to a lighting socket, a reflector lamp is hung by a chain from the radiator cap and keeps the water from freezing. In an unheated garage, during cold weather, the car will be safe, will start more easily and there will be a consequent saving on batteries by using this lamp, it is claimed. The reflector is intended to insure distribution of the heat where it is most needed.



For Accuracy in Surveys; Rod Is Little Affected by Temperature Changes and Has Thermometer

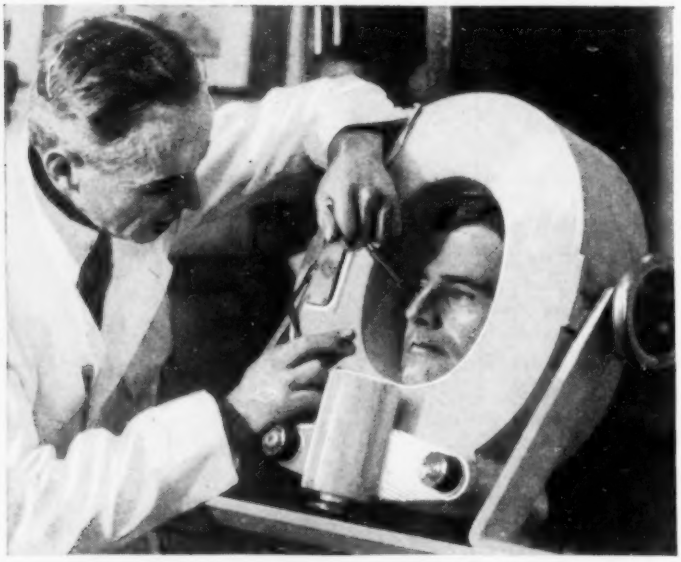
THERMOMETER IN LEVEL ROD AIDS ACCURATE SURVEYS

For running lines to determine the elevation of points above sea level, the coast and geodetic survey employs a special rod that is said to change scarcely at all in length under the most trying conditions of temperature and humidity. It is made of invar alloy, and carries a built-in thermometer for temperature corrections.

HIGH-SCHOOL AVIATION COURSE TO PROMOTE FLYING

Fundamentals of flying will be taught to Chicago high-school students, according to present plans of the board of education. Aviation and radio experts have been invited to assist in preparing a suitable course. The subjects will be made part of a general mathematics course.

¶Buttercups and daisies are found in great profusion north of the Arctic circle.



Drawing Metal Fragments from Patient's Eye with Aid of Special Magnet; Current Is Turned On in Rim about Face

METAL EXTRACTED FROM EYES WITH RING MAGNET

One of the most effective aids to the eye surgeon is a magnet for pulling out particles of metal that may become lodged in the organ where they cannot be removed easily by other means. The patient's head is placed inside a ring, the current is switched on and a metal instrument collects the fragments of metallic substance that may be in the eye.

TRADE IN MOLESKINS FOR FUR TOTALS MILLIONS YEARLY

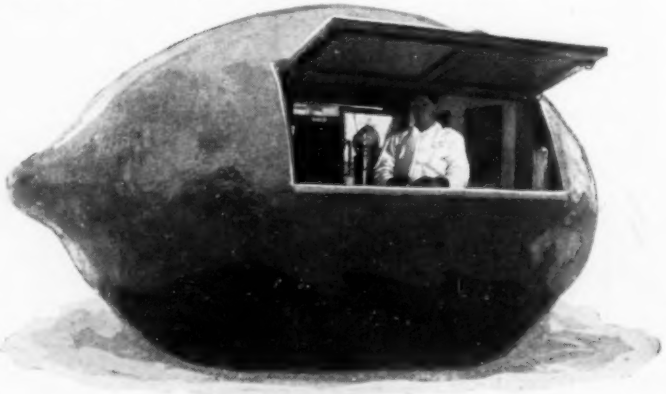
Once considered chiefly as a pest, the mole is now regarded as an important article of commerce, since the demand for its fur involves a business of more than $2,000,000 in this country annually. The most desirable varieties come from abroad, but more than $100,000 worth of raw American moleskins have been marketed for fur. While the animal works considerable injury to crops, it is sometimes of benefit in destroying harmful insects. In certain localities, trapping moles has proved a profitable undertaking, twenty often being taken from one spot.

THOUSAND LEPROSY CASES CURED IN FIVE YEARS

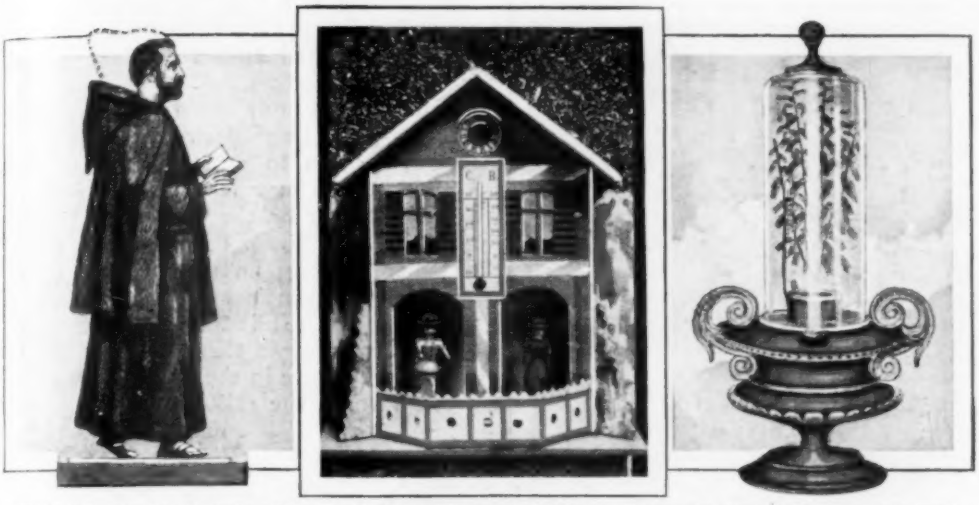
That leprosy is yielding to science is shown by reports from the Philippine islands, where 1,000 cases have been cured in the last five years and many others kept under control. The progress has been attained by treatment with a special oil which has been found of benefit in curing the malady. Some medical men declare that almost complete eradication of the disease will be possible within ten or twelve years. An appropriation of $2,000,000 was asked from the United States to help fight the plague.

LEMON-SHAPED DRINK STAND HELPS DRAW CROWDS

Thirsty motorists traveling a highway in Oregon are attracted to a refreshment stand, shaped like a huge lemon, at the side of the road. It is brightly colored and is equipped with modern conveniences for the serving of soft drinks.



Novel and Useful, the Lemon-Shaped Refreshment Stand Can Be Tightly Closed to Protect Contents from Weather



Three Primitive but Ingenious Weather Prophets; Atmospheric Changes Draw the Monk's Cowl over his Head When Storms Come, Make the Weather-House Inmates Move, and Color the Weather Plant

What You Can Believe about Weather Lore

Many Proverbs, Proved to Be Useful Records of Human Experience, Tersely Put

FORECASTING weather must have been one of the earliest forms of prophecy. Even nowadays there is scarce a village community that has not its local seer, and what the weather bureau calls "folk meteorology." Many of the proverbs regarding the weather are the useful records of human experience, tersely put.

Almost everyone knows, for instance, that the amount of moisture in the atmosphere affords in some degree an indication of coming weather. If the air is dry, there is prospect of clear skies; if increasingly humid, rain may be expected.

Dwellers along the seacoast of New England hang up a dried bunch of seaweed to obtain advance notice of weather changes. When a storm is approaching, it becomes damp and flabby. When it dries out, there is reason to expect clearing.

There are a number of other weather-forecasting devices which also depend for their usefulness upon absorption of moisture with more than ordinary readiness. Among them is catgut, which is the operative element of the familiar toy called a "weather house."

In Germany, where that kind of toy is made, the two figures that alternately come out of the doors are called the "little weather husband" and the "little weather wife." With clearing weather, the woman appears; threat of a storm brings out the man. Both stand on a platform which is suspended by a string of twisted catgut. When the air turns moist, the catgut absorbs some of the wet and tends to untwist; when dry, it twists tighter. The platform turns responsively, the figures swinging in and out.

Another contrivance is a figure representing a man in monkish costume, with a cowl. In moist weather, the cowl is drawn over his head, to protect him from the damp; when the skies are clearing, the cowl drops down behind. Again it is a concealed catgut string that pulls the hinged cowl over the monk's head or allows it to fall back.

Yet another is a manikin that lifts an umbrella over its head in anticipation of rain. Projecting backward from between its shoulders is a horizontal pin, to which a tiny umbrella is attached by its handle. Around the pin is coiled a long-beaked geranium seed. When the air is damp, the seed coils itself tightly and raises the umbrella to the vertical; as it grows dry,

A Live Frog in a Glass Jar Indicates Weather Changes, by Climbing the Ladder When the Lookout Is Fair, and Descending before Storms; Right, a Chemical Barometer in the Form of a Flower

THE MAGIC BAROMETER FLOWER
This little flower you must grant
Is something of a sensitive plant.
Place it in the open air,
'Tis Pink when stormy, Blue when fair,
And turns a lovely Lilac hue,
When undecided which 'twill do.

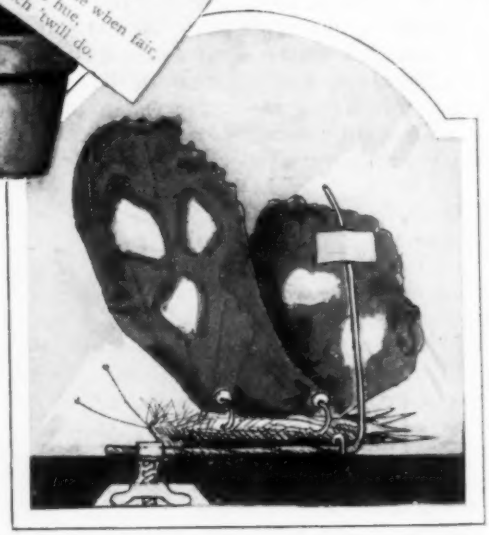
the seed uncoils and the umbrella drops to the rear.

In Germany and Switzerland a living four-legged prophet is commonly kept in houses to foretell atmospheric changes. It is a little green tree frog, and its domicile is a glass jar, half full of water and covered with a piece of muslin tied on with a string, to prevent the prisoner's escape. In the jar is placed a small ladder. When bad weather is in prospect, froggy stays at the bottom. With clearing skies, it mounts the ladder, and if the day is going to be fine, it ascends to the top, out of the water.

An Australian, named Nowack, spent a fortune in trying to persuade the world of the usefulness of a certain plant for weather forecasting. It was the "paternoster pea." When the outlook is for fair weather, its leaves stand upright. With approaching rain they decline. If a big storm is coming, they hang straight down. Nowack claimed that the plant would foretell earthquakes.

Familiar in our own country are weather-predicting devices which owe their invention to a Frenchman named Lenoir. They may take the form of an artificial flower or the dress of a female manikin. The flower or the dress is made of paper treated with a chemical solution of which the principal ingredient is chloride of cobalt. It is blue when dry, but changes to lilac and then to pink with increasing moisture in the atmosphere.

The farmer, the sailor, and the fisherman are stanch believers in weather "signs," some of which are fairly reliable, while others possess no value whatever. In the latter category is a notion, commonly held, that thick husks on ears of corn portend a cold winter. If acorns are unusually plentiful, there is a like prospect. Many people have firm



The Wild-Oat Butterfly Changes the Position of Its Wings When Rain or Shine Is the Prospect

faith in the "goosebone"—the breastbone of a goose eaten at Thanksgiving—which, if thick and solid, means a hard winter coming. If thin, the weather will be mild; if mottled, it will be changeable.

Also, there is a popular belief that muskrats build their houses earlier when a severe winter is in prospect. In like case, it is said, the opossum takes up winter quarters underground, whereas, if the weather is going to be mild, a hollow tree is preferred. Squirrels are alleged to store greater quantities of nuts in expectation of more than ordinary cold.

None of these ideas seems to have any basis in fact. Nor is there any good reason for believing that pigs "smell" an approaching storm. Insects, however, are incommoded by condensation of moisture on their hairs. Hence bees, sensitive to the increase in humidity that precedes a shower, return to the hive to escape getting wet. It is true also that swallows fly low before a storm, and they do so because the insects fly low, the air near the ground being less humid than aloft.

A collection of weather proverbs made by the weather bureau shows that such sayings contain much sound sense, based as most of them are upon correct observation. This remark applies particularly to atmospheric phenomena. Where the heavenly bodies are concerned, popular notions regarding their influence upon weather are said to be erroneous. The common belief that the moon exercises more or less control over the weather is wholly unsupported by scientific fact.

Nevertheless, the moon is not without its usefulness for weather observation, inasmuch as its appearance varies with atmospheric conditions:

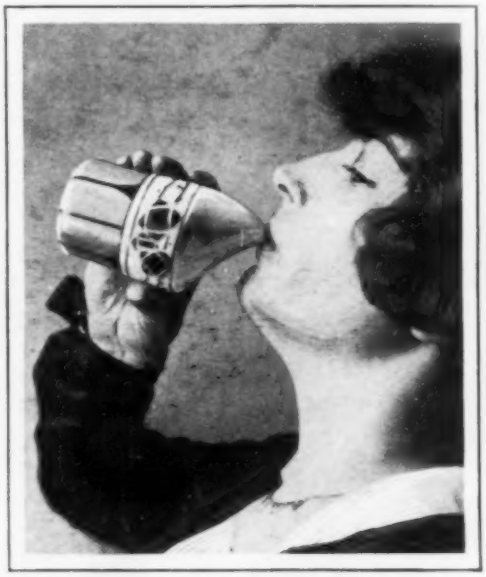
> "If the moon show a silver shield,
> Be not afraid to reap your field.
> But if she rises haloed around,
> Soon we'll tread on deluged ground."

The "silver shield" indicates a dry atmosphere, promising clear weather for the next day. The "haloed" appearance betokens a moist atmosphere, suggestive of coming rain.

The "new moon with the old moon in its arms" has long been accepted as a sign of coming fair weather. And rightly so, inasmuch as the phenomenon is only visible when the atmosphere is very dry.

DRINKING GLASS WON'T SPILL IN ANY POSITION

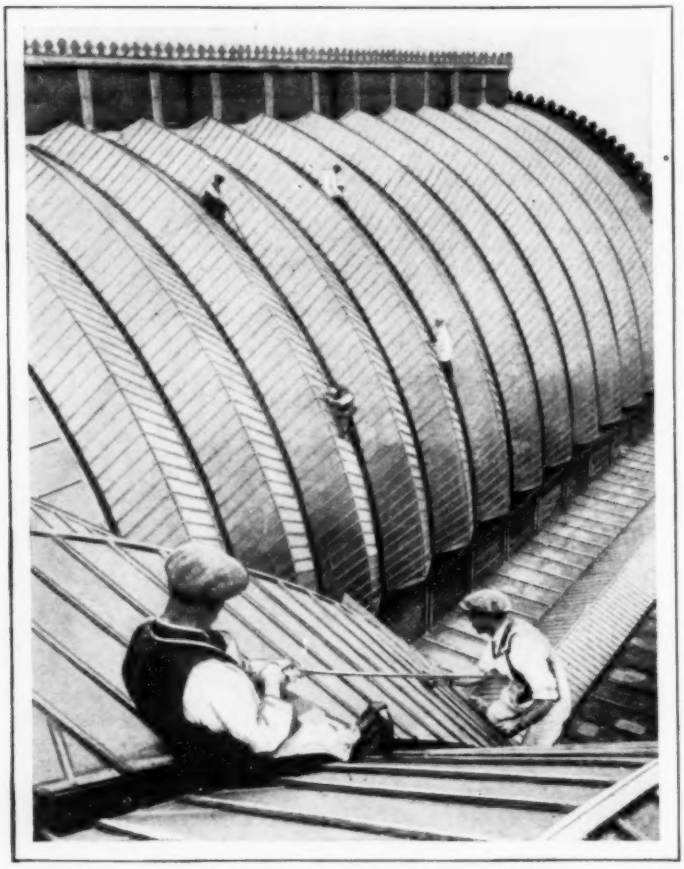
Designed especially for the convenience of travelers and sick persons who must remain in reclining position while drinking, a glass introduced by a Paris physician has a spout-shaped top which is said to prevent spilling the contents. It may be used with ease on rough sea voyages as well as in the sick room, and when upright and in a stationary position it keeps the liquid from spilling.



Drinking Glass with Spout Prevents Spilling; a Specially Desirable Feature When Traveling

TRAIN IS ANNOUNCED BY BUGLE AS SUBSTITUTE FOR VOICE

Passengers, awaiting the departure of the Broadway limited from the Pennsylvania station in New York, are not likely to miss the train through any oversight in the announcement of its leaving. To summon travelers to the gates, a bugler blows the army assembly call five times from three different places in the station, and one minute before the train departs, the forward call is blown from a position near the coaches. The innovation has attracted wide attention throughout the huge terminal and suggests an earlier time in transportation, when horns were used on horse-drawn stagecoach routes.



Roped Together for Safety, These Workmen Are Polishing Some of the 100,000 Pieces of Glass in Roof of Crystal Palace

CLEANING "MOUNTAIN" OF GLASS REQUIRES EXPERT CLIMBERS

While overhauling and cleaning the 100,000 pieces of glass that make up the roof of the Crystal Palace in London, workmen were roped together like Alpine climbers and had to exercise the greatest skill in order to avoid falls that would probably have been disastrous to life, and property as well. The inspection is made once a year.

DOCTOR OPERATES WITH SPOONS TO SAVE SEAMAN'S LIFE

How a ship's surgeon, using such crude implements as spoons, safety pins and meat hooks, performed an emergency operation for appendicitis on a fireman of the steamer "Port Auckland" while rounding the Horn was told recently by members of the ship's crew. The doctor, A. S. Hethrington, was on his way to England for the first time after being graduated from Dunedin university, in New Zealand, when the fireman's illness was reported to him. Examination showed that an operation was needed at once. Converting the steamer's dining salon into an operating room, and enlisting the services of a woman passenger, who had been a nurse, and two of the ship's officers, the surgeon made the incision with a pair of scissors after administering ether and chloroform to the patient through a tea strainer covered with a towel. The patient's tongue was immobilized with a safety pin, and the wound was kept open with bent spoons, clothes pegs and meat hooks. The instruments were sterilized by boiling water from the cook's galley. Although the vessel's engines were stopped, there was considerable movement of the ship because of the waves, yet the operation was successfully completed after nearly three hours.

POCKET CANOE SPONSON ENDS DANGER OF "SPILLS"

Ordinary canoes can be quickly transformed into "unsinkable" boats by attaching inflated rubber supports to the sides. The bags are of cloth and rubber, about four feet long and six inches wide, and can easily be blown up with the breath. When deflated, they fit in the pocket.

FRUIT RIPENED MORE QUICKLY BY STORING IT IN GAS

By placing fruits and vegetables in an atmosphere of ethylene gas and air in the proportion of one part to 1,000 by volume, a Minnesota professor has developed a process for ripening the products more quickly and preserving and improving their color. The treatment is not injurious to the articles or to the consumer and is not expensive. Tests with it have shown that celery can be bleached in twenty to thirty hours; bananas, tomatoes and melons are ripened in forty to fifty hours and green fruits can be kept in storage longer without fear of spoiling. The fruits and vegetables are kept in gas-tight cellars at a temperature of sixty degrees Fahrenheit and about thirty-five cubic feet of gas is sufficient to treat twenty to forty carloads of products, it is said.

GLASS PATROL ON MOTOR ROADS SAVES AUTO TIRES

One of the latest aids to motorists in California is a special patrol service to remove bits of broken glass from the highways. A man with motorcycle and sidecar keeps constant vigil over the roads, sweeping up fragments of glass, etc., that are likely to puncture tires. The plan will, no doubt, save autoists thousands of dollars annually.

Gathering Up the Glass Fragments Before They Puncture Tires; the Patrol Detail on Duty

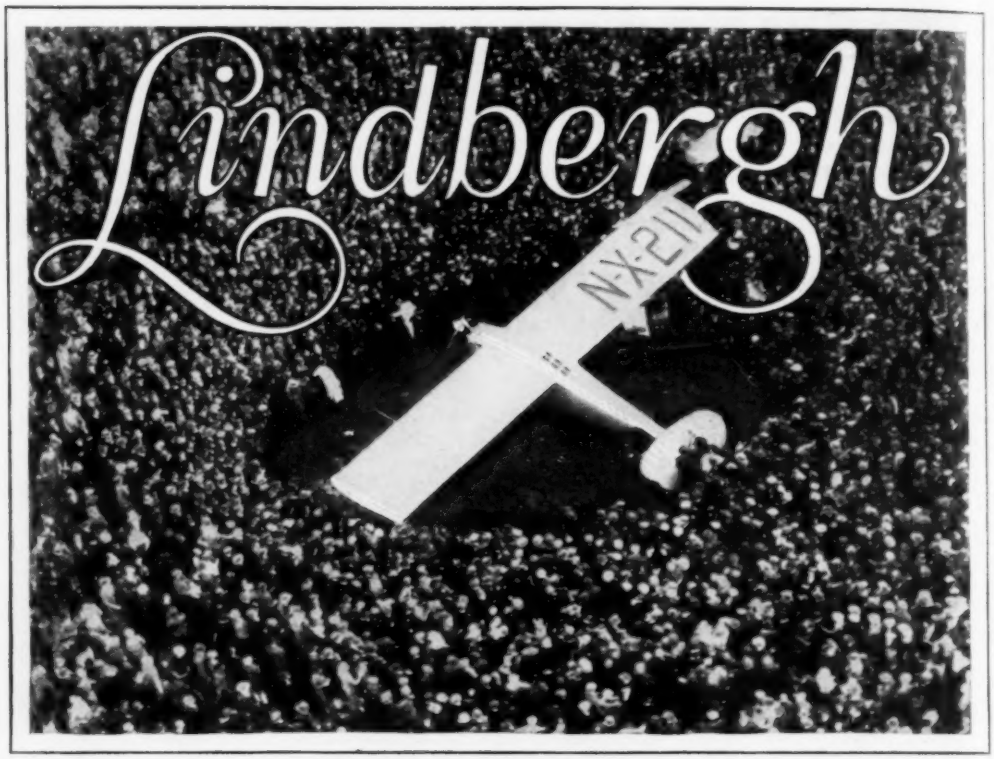
Ladder for Washing Overhead Street Lamps Does Not Obstruct Traffic, and Saves Time

TELESCOPE LADDER SIMPLIFIES STREET-LAMP CLEANING

Street lights in Switzerland are kept clean by frequent washings, and one of the aids to the work is a portable, telescoping ladder. It is easily extended or folded up and is so securely balanced that the workman can safely mount it. The rig does not obstruct traffic.

POSSUM CARVING ON CATHEDRAL LATEST DECORATION IDEA

In keeping with the provision that various forms of animal and plant life found within the area be used for decoration motifs on the cathedral of Sts. Paul and Peter, in Washington, D. C., an opossum is to have its likeness carved into the great structure now under way. The animal was captured on the cathedral grounds and was posed for a sculptor. When finished, the building will constitute a stone record of the animal, bird, insect and flower life of the neighborhood.



One Small Section of the Crowd Which Swept through the Police Lines at Croydon Field, Just Outside London, to Greet Col. Charles Lindbergh When He Landed in the British Capital

By DONALD E. KEYHOE

AMERICAN commercial aviation, until recently a topic of ridicule, will lead the world within a few years, according to Col. Charles A. Lindbergh, transatlantic flight hero.

"Of course, no one can accurately forecast the final effect of aviation upon the world," he said. "We can go ahead a few years and show the general trend beyond that, but no one can tell just how far flying will take us.

"It will have a great effect, just as have steamships, railroads and automobiles. But I believe the change will come more quickly, because the airplane has developed more rapidly. In less than twenty-five years it has grown from the crudest experimental stage to a safe, reliable carrier with many conveniences and comforts."

He turned to a table on which was spread a map of the world.

"The best basis for estimating the future is to look at the present. You can see that Europe seems to have everything its own way in regard to commercial lines. On many of these lines they are using large multi-engined cabin ships, equipped as comfortably as Pullman cars. They run on regular schedules and are used by travelers just as we use our own trains in the United States.

"The real reason for their success is that they are subsidized by their governments. Almost every European commercial line is subsidized from fifty to ninety per cent of its operating cost. Naturally they have been very successful, for they do not have to worry about overhead and deficits."

He drew the map closer and indicated the United States, over which a smaller network of airlines was drawn.

"This country began slowly. The post office department established an air-mail line in 1919, from which grew the transcontinental route. This line has been very successful. It is the backbone of

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tells Future of AVIATION

the present contract air-mail system, as almost all other routes feed into it from outlying sections. The mail airways now cover between 7,000 and 8,000 miles, and over 16,500 miles are flown daily on these routes. This is regular, scheduled flying, and does not include miscellaneous operations, such as photographic work, cotton dusting, sight-seeing, taxi work and similar projects.

"These lines are the basis of the future great passenger lines. Even now, some of them carry passengers, and others are planning such service. Five lines are beginning express service. New routes are being established to transport mail, express and passengers, so that, by the end of 1927, there will be over 11,000 miles of airways, and more than 22,000 miles flown daily—on schedule."

"What kinds of planes will be used on these lines?" I asked.

"Modern ships," he answered with emphasis. "On a few routes mail alone will be carried, but most contractors are trying to include passengers and express. On shorter runs, or in starting new lines, small ships may be used, such as single-engined cabin or open types capable of transporting from two to four passengers besides the pilot. As the traffic increases, and on the longer lines, these will eventually be replaced by multi-engined planes with large cabins, equipped with heating and ventilating devices, wide windows, comfortable seats and many other conveniences. Such ships are now in existence and are in use on a few routes."

"Hasn't most of this sudden increase of aviation interest followed your transatlantic flight?" I suggested.

"Each one of the recent flights has had a part in arousing interest," Col. Lindbergh countered. "The people of the United States may be fairly said to have become 'air-minded.' However, this could not have happened if our natural progress did not warrant it. It is not a boom which will let down in a short time. The change is here. People are ready to fly and to use airlines as fast as they are established. Capital has been quick to note the swerve of the public, and is ready to back new

"Lindy" Ready to Take Off in a Fast Army Pursuit Plane, in Which He Flew from Washington to New York

Ambassador Myron T. Herrick Pointing to "Lindy's" Cross of the Legion of Honor, Conferred by the President of France

routes as rapidly as they are advertised for mail contracts. The industry is advancing swiftly."

Enthusiasm began to show in Col. Lindbergh's manner and his tone as he went deeper into his favorite subject.

"The government should be credited for the increase in public confidence, at least to a large degree. The department of commerce has done valuable work in establishing lighted and marked airways, similar to the greater portion of the transcontinental. The resulting night flying will speed up business mail from all parts of the country.

"For example, take the line which is now being lighted from New York to Atlanta, and which will soon commence operation. A letter mailed at the end of the business day in New York will be in Atlanta by six o'clock next morning. It will immediately be transferred to another mail plane, which will give delivery during the early part of the business day at Jacksonville, Miami and other Florida cities.

"Similar cases are found in the feeder lines from Dallas, Boston, the Twin Cities, St. Louis, Detroit, Pittsburgh, Pasco, Los Angeles, Seattle and numerous cities between these terminals. All the cities on the transcontinental, from San Francisco to New York, benefit by this efficient mail service."

He paused for a moment.

"What about safety?" I inquired. "The public is still hazy about that."

"Regular commercial flying is safe," he replied with conviction. "Almost all scheduled service is given by licensed planes, operated by licensed pilots and maintained by licensed mechanics. This is required in interstate commerce by federal law. Even in intrastate commerce, pilots must obey federal air-traffic rules, and planes must bear identification numbers. The end of the reckless 'gypsy' flyer with his unsafe plane is in sight. State laws will probably be passed requiring federal licenses, or the equivalent, and concurring with other federal air laws.

"Most of the accidents have been due to unsafe equipment and inexperienced pilots—that is, in commercial aviation. In military work and experimental flying certain risks are necessary which are not a part of commercial flying. Straight flying in a commercial ship is as safe as riding in an automobile, and often more so."

"Many people believe that the airplane is a fair-weather craft," I told him. "What is your opinion of that?"

"Airplanes can fly now under all conditions but in sleet," he stated. "Sleet forms on the wings and changes the camber, in addition to increasing the weight. Heating the wings or some other method will change that. The only other difficulty is flying in fog. The actual flying is not hard, for with modern instruments a pilot can take off today and fly without seeing ground or sky for a long time. In landing, however, he has trouble. This latter obstacle will be overcome in the near future by radio signals, fog-piercing lights, special altitude instruments or some other means. The radio beacon is a great help in fog, as a pilot can tell when he is even slightly off his course on either side."

While Mrs. Coolidge, at the Left, Smiles Broadly and His Mother Looks On, Col. Lindbergh Receives the Distinguished Flying Cross from President Coolidge in Washington

Col. Lindbergh stopped and considered for a few seconds.

"That is a general picture of our commercial aviation today," he continued finally. "It has grown up on the solid foundation of private enterprise. Now that the public is realizing its value, and is supporting it, commercial flying will grow rapidly.

"With all this as a foundation, we can make a survey of the immediate future. Within the next few years a very complete network of mail, passenger and express lines will cover the United States, connecting with Canada and Mexico. The most modern ships will be used, and will be flown by licensed pilots of long experience, and under strict regulation. They will use the civil air lanes, which will be plainly marked and lighted, with landing fields at intervals necessary for safety. The whole country will be air-marked, so that day or night pilots will be able to tell where they are, except when visibility is very poor. Then the radio beacon and other radio signals will be used.

"Experts will provide complete weather forecasts and reports for any desired route or airport on a route, to eliminate danger of flying into bad conditions. Most of this information will be given planes in the air by radio. Airplane pilots will receive orders just as engineers now get them from train dispatchers, and lines will be handled as methodically as railroads.

"The planes used will be increased in size according to the demand. Dining compartments, sleeping berths and other similar improvements already have been proved practicable, and will be put into regular use in the United States as soon as the public wishes them. Judging from the constant increase of interest and enthusiasm, that time is not very far ahead."

"What will be the first apparent changes?" I asked him.

"Establishment of airports all over the country," he replied tersely. "Then, marking of cities, towns, villages and prominent objects to guide airmen. Next, passing of the idea that flying in commercial ships is a great hazard. The next generation will be born without a fear of the air, because the airplane will be accepted just as the automobile is today.

"The United States will pull ahead of

other nations because of its favorable geographic situation. By that, I mean the long distances between important business centers, and the good flying country intervening. Also, the high value Americans place on their time will help, as will our efficient production methods. Manufacturers today cannot keep up with the demand for planes. This will soon force them into quantity production, putting the aeronautic industry in its rightful position."

"You have been quoted in various ways in regard to transoceanic flight," I remarked. "What is your idea of this?"

"Transoceanic flight will not be regularly established for several years," he answered. "There is need for more research, and for development of special planes intended for that service. Probably flying boats will be used, with some reliable means of fueling them at sea. Land ships will probably not be used, as this would be about the same as using seaplanes for regular service across the continent. Commercial operations in the Atlantic will come before such activity in the Pacific, mainly because of the greater business over the Atlantic."

"Beyond the immediate future, what do you think aviation will mean?" was my next question.

Col. Lindbergh hesitated.

"That is hard to say," he answered slowly. "Of course, we shall have heavy air traffic. It will bring difficulties in handling, particularly as to air lanes, altitudes, parking of aircraft and other related matters, but all these will be solved because of the necessity. Air commuting will become customary, I believe, and probably living in the open country will be more popular. Real-estate values will be changed, and open stretches between neighboring cities may become very well settled. Communities will naturally be brought closer together, and all business will be transacted more efficiently through speedy communication and travel. The airplane will never entirely supplant the railroad or the automobile, however, as each has its own place in our lives. It will be a good, safe carrier, ready to serve anyone who demands speed."

"There is one matter you have not touched," I said. "That is the effect of commercial aviation on preparedness."

He considered carefully before answering this.

"Building up of commercial aviation will certainly give us more protection by adding to our air resources," he said at last. "By having the means to enforce respect we shall keep out of trouble. Everyone

When He Was Just "Slim," a Mail Pilot, Waiting in New York for Favorable Weather to Hop Off for Paris in the "Spirit of St. Louis," the Plane That Is to Be Presented to the Smithsonian

should realize that commercial-airplane factories will be available for turning out military planes if necessity should arise. Commercial ships themselves will not be of much use as war planes, but no great change in machinery will be required to turn out military types, after factories are built and forces of designers and constructors are skilled in that particular work.

"In addition, commercial pilots could be trained for military flying without much difficulty. In this way commercial aviation is certain to be of great value by keeping us supplied with the means for aerial protection."

"With these great developments in aviation, there should be many opportunities for young men," I said. "What is your advice to those who would like to take up that work?"

"Lindy," Leaving the Tomb of the Unknown Soldier at Arlington Cemetery with Maj. Gen. Samuel P. Rockenback and His Staff

"That depends on each case," he replied. "If a man wished to follow the engineering and construction phase, he would be best fitted by attending a college or university which gives a complete aeronautical-engineering course. There are several of these already. If he wished to get into actual flying, he might try the army-cadet course, which is as complete as any in the world. If the age limit or the lack of vacancies prevented this, he could try one of the various commercial schools."

"In your own case, though, didn't you follow this method for some time prior to your first flight?" I inquired.

Col. Lindbergh grinned frankly at this.

"Yes, I did some 'barnstorming' and 'gypsy' flying before I soloed. It consisted in parachute jumping, wing walking and cross-country flying. My first instruction was at Lincoln, Nebr., in 1922, but I did not fly alone until 1923, at Americus, Ga. In fact, I had not been in a ship for over six months before the day I soloed."

"Don't you think this 'barnstorming' experience helped you in learning to fly?" I interposed. "That is, the time when you were not at the controls?"

"Yes, it did," he replied. "I think any time put in as a passenger helps the student flyer. It takes away the feeling of strangeness and makes him more at home in the air. I know many instructors disagree with me, but I think even riding as a passenger in a cabin plane has its value."

He paused and smiled reminiscently.

"I was thinking of my first solo," he explained. "Of course, no pilot ever forgets that. I had bought an army 'Jenny' (JN-4) at Americus, and had had it assembled. No one paid much attention to

me, because I was supposed to have soloed before. I started to take off when the plane was ready, but the air was rather bumpy and I found I had not retained the full feeling of control, so I decided to wait until there was less wind.

"Luckily, another pilot at the field gave me a 'check' hop, during which I made several landings. That brought back my flight sense and also my confidence, so that, when the air calmed a little toward evening, I made ready to take off.

"There was an unusual incident in that first flight which few people know. The first few minutes went all right. I took off carefully and climbed gently, without any steep turns. My confidence grew with every second, and I began to feel very glad that I had at last reached this moment, my first time alone in the air—but just then the motor sputtered and started to cut out.

"I was directly over the center of the field. I remember nosing the ship down, wondering whether I would be able to make a safe landing, for it looked as though my first would be a forced one. It seems funny now, for the field was big enough to put any plane down, but it wasn't funny then. While I was still figuring what to do, the engine picked up again. That made me feel better, for the roar of your engine is a great comfort to you on that first solo hop.

"After about fifteen minutes I throttled down and glided in for my first landing. It was all right—at least I was able to take off and try again. I made several short hops that evening, stopping when darkness came."

"One more question," I requested. "Do you think the average man can learn to fly, or does it take especial skill?"

"I believe the average man can learn to fly without difficulty with the present commercial plane. Also, I think that learning will be easier in the future, when controls will be simpler and planes will be built which will not stall or spin under any circumstances. For military flying, I think more than ordinary instinct is necessary. Some people are born flyers and there will be more such in the future, but even now the average man can make a good pilot."

PARCEL CHUTE AS CHILD'S SLIDE GIVES FUN AND EXERCISE

From an old package chute, taken from a store, a Los Angeles man fashioned a children's slide which has proved popular in his neighborhood. The only work required was to build supports to hold the metal trough upright and to erect a stairway to the top. A pile of sawdust at the bottom serves as a cushion.

No Longer Useful for Store Purposes, This Parcel Chute Has Been Put to Good Services on Children's Playground

FITCH THE FATHER OF STEAMBOAT

While the invention of the steamboat is popularly associated with the first trip of Robert Fulton's "Clermont" from New York to Albany, Aug. 11, 1807, proof has been disclosed showing that John Fitch was ahead of Fulton by at least twenty years with a steamer that was a mechanical success, although it failed to win its inventor the recognition that his successor attained. Walter W. Jamison, of the Massachusetts Institute of Technology, has discovered that, by 1790, the legislatures of New Jersey, Delaware and Pennsylvania had voted Fitch "exclusive rights in navigation by steam and fire," and that a committee of the New York legislature declared, in 1817, that Fulton's steamboat was, in substance, "the invention patented by Fitch in 1791." According to Gov. W. J. Fields of Kentucky, there is a letter in the records of congress showing that Fulton himself recognized Fitch as the inventor of the steamboat. On Aug. 22, 1787, according to data gathered by Mr. Jamison, Fitch tried out his third steamboat on the Delaware river before members of the constitutional convention, but the speed of four miles an hour did not satisfy those financially interested in the project. Next year, he succeeded in building a larger vessel, and it made a trip of twenty miles with thirty passengers in three and one-quarter hours, but still the speed did not meet with the approval of those backing the undertaking. Fitch's later efforts met with financial failure, and he died in disappointment.

An Apparently Cramped Position, But It Proved a Good One for Marksman

LEG STRAP HELPS MARKSMAN TAKE ACCURATE AIM

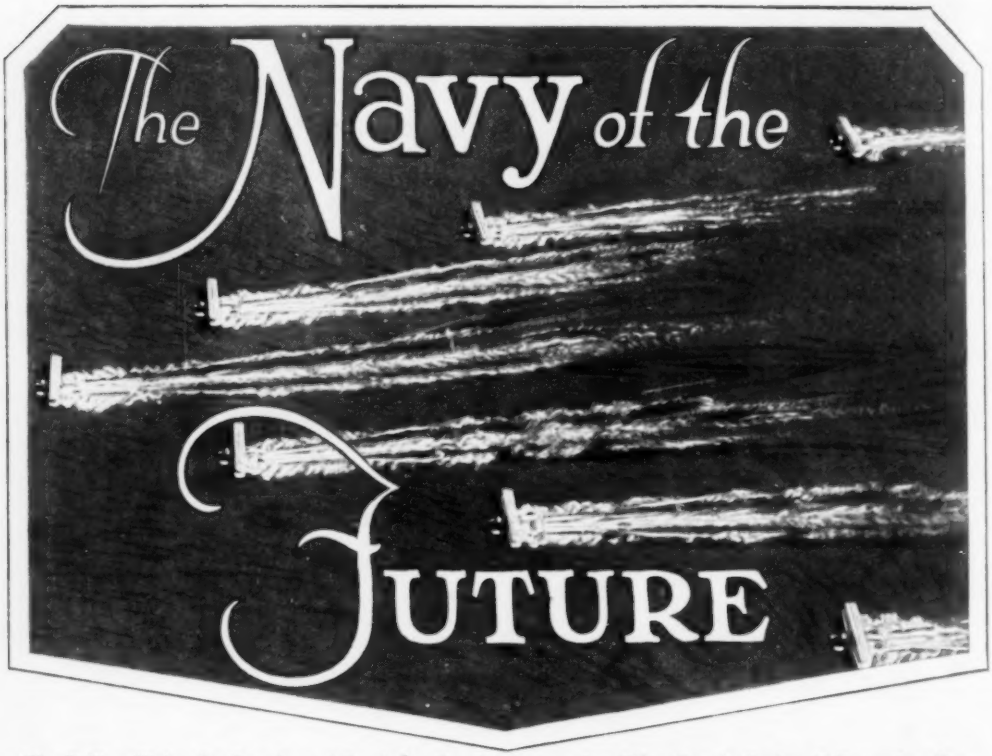
What is the best position for accurate rifle shooting? A British marksman demonstrated that departure from conventional form is sometimes effective, if it affords a steady support for the piece and a good view of the sights. A strap fastened to his right leg and held between his teeth braced him while firing.

BEAUTY CREATED FROM CACTUS BY UNIQUE CRAFT

To most persons, the giant cactus of the deserts is a worthless growth, but to an Arizona craftsman, the plant is a source of livelihood and furnishes the materials from which he makes beautiful and useful objects. Lamps, watch charms, cushions and many other articles are among the things he constructs, and some of the products are further decorated by means of a process he has discovered for plating the material with metals, such as copper, gold and silver. He has followed the craft for years and won awards at the Chicago world's fair.

Created from Cactus, Lamp Shades and Bases of Desert Growth Make Unique Decorations

The Navy of the Future



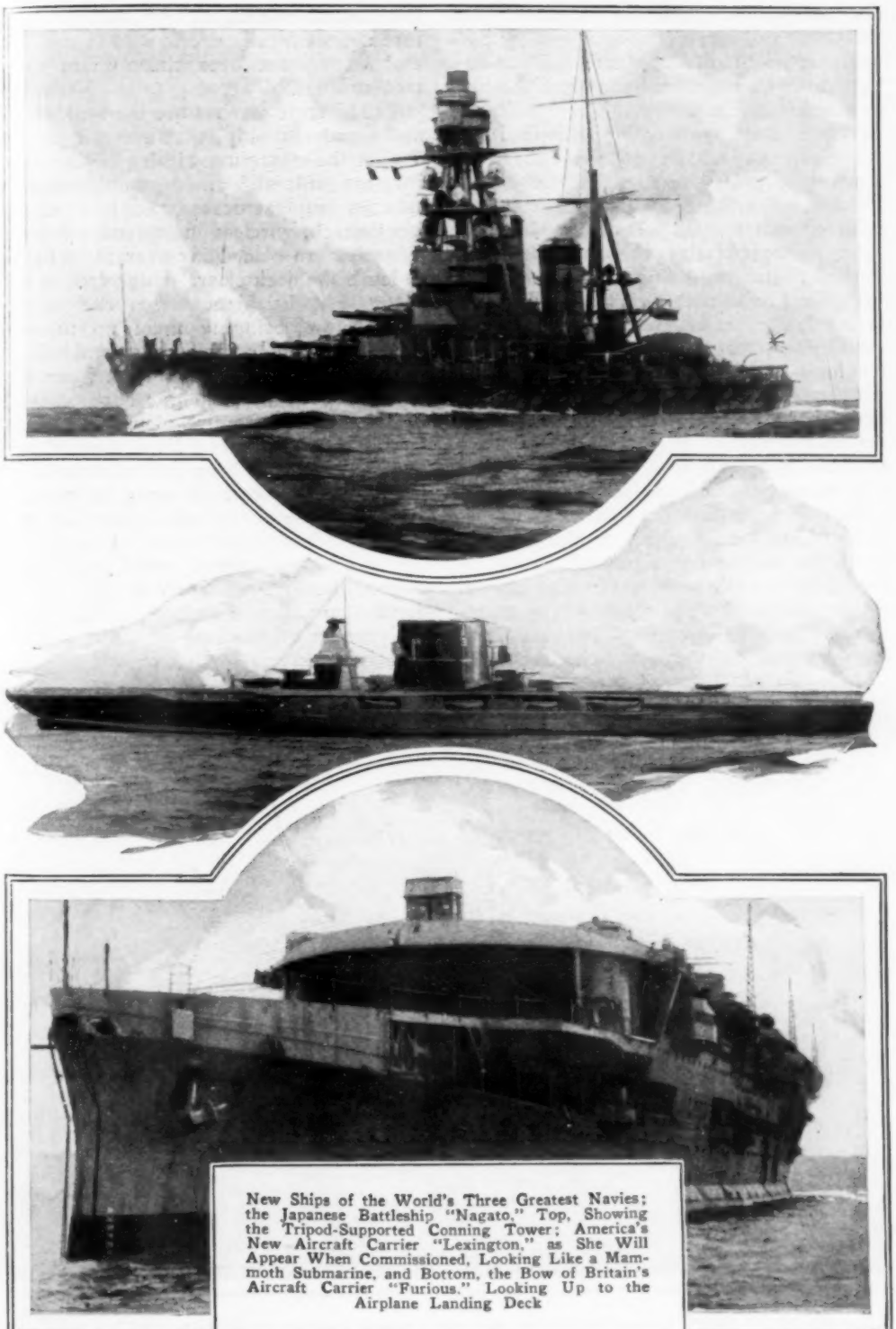
The Boiling Wake of a Squadron of Seaplanes, Speeding across San Diego Bay in Perfect V-Formation, Preparatory to Taking the Air as the Eyes of the Pacific Battle Fleet

FIVE epochal flights across the seas, three to France and two to Hawaii, last spring revived again the recurrent claims that forty-million-dollar battleships are obsolete and that the war of the future will be fought in the air.

A fleet of medium-sized coast-defense submarines to protect principal ports against surprise attack, and a vast fleet of flying fighters to carry on the war in the air, are all that is needed in the way of a navy, according to the enthusiasts. But leading naval authorities, while giving full credit to the marvelous performances of Lindbergh, Chamberlin, Byrd, Maitland and Smith, refused to be disturbed by the prospect of any immediate revolution in naval warfare.

For, they hold, the development of aircraft, which has been swift and startling, is not an indication that battleships are doomed, but that battleships, in conjunction with aircraft and utilizing the services that aircraft can perform, will become more and more deadly as weapons in future wars. And to accomplish that union of sea and air, they have quietly been revolutionizing the surface ships, while speeding the development of faster, bigger and better-armed planes.

Owing to the disarmament treaty reached at Washington, little has been done to develop the world's navies in accordance with the lessons of the World war and to utilize aircraft to the best advantage, for it has prevented the building of a single post-war battleship in the United States and only four have been built abroad, the "Rodney" and "Nelson" in England and the "Mutsu" and "Nagato" in Japan. But the United States, within a few months, will have added to its fighting fleet the last word in airplane carriers, when the powerful and mighty "Lexington" and "Saratoga" go into commission. Their keels were laid before the Washington conference, and, had that treaty not been signed, they would have been completed as great battlecruisers, rivals of England's 41,000-ton "Hood," largest warship in the world. Instead, under the treaty terms which permitted



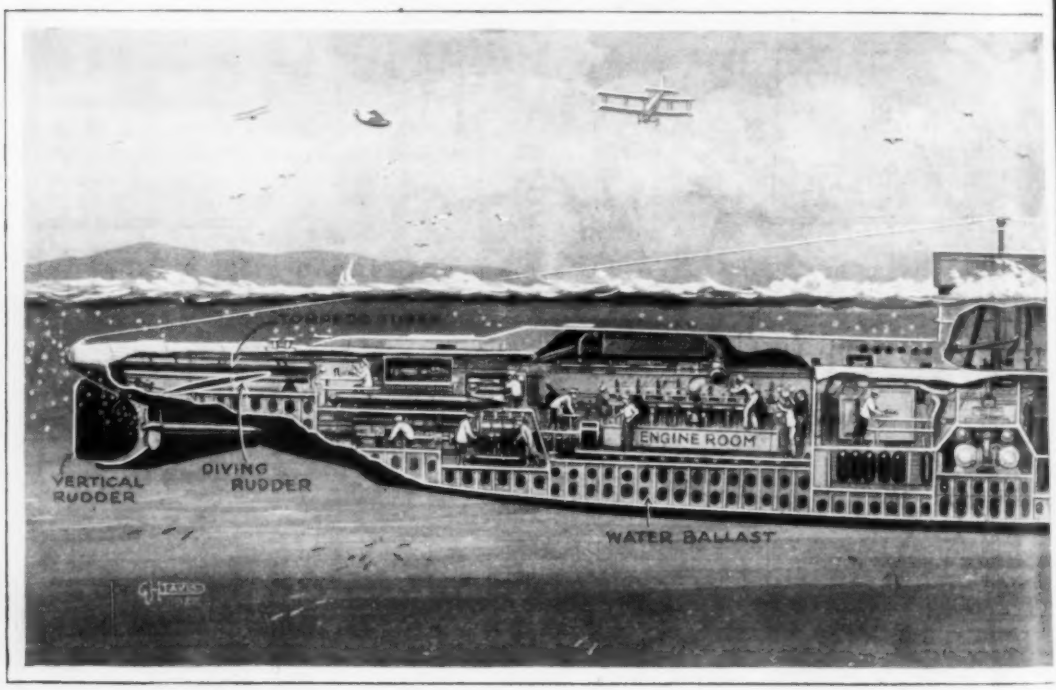
New Ships of the World's Three Greatest Navies; the Japanese Battleship "Nagato," Top, Showing the Tripod-Supported Conning Tower; America's New Aircraft Carrier "Lexington," as She Will Appear When Commissioned, Looking Like a Mammoth Submarine, and Bottom, the Bow of Britain's Aircraft Carrier "Furious," Looking Up to the Airplane Landing Deck

England to complete the "Rodney" and "Nelson" and scrap four or five older battleships, the United States was allowed to change its plans and complete the pair as aircraft carriers.

When they go into commission, the American navy will have three of the finest floating aircraft hangars in the world, including the "Langley," which was constructed from the old fleet collier "Jupiter." Few laymen realize the fact that the United States is leading the world in development of its seagoing air force. Every major battleship and cruiser is equipped with planes and a launching catapult. England has just begun to experiment with catapults, and the rest of the world lags far behind, whereas we have had them for several years. We have the only submarines equipped with their own scouting planes, carried in water-tight steel drums on deck and capable of being assembled and launched in five minutes. We have the fastest naval pursuit planes in actual service, the highest-climbing planes, the fastest-climbing planes, and the greatest load carriers for their speed and "ceiling"—all records that were being set while the transatlantic flights were on, and therefore almost totally overlooked in the general excitement over those more spectacular feats.

The aircraft carriers are the most weird and wonderful ships that ever put to sea. To get the maximum width of flying deck, they are built with an enormous flare, and all the superstructure, control rooms, smokestack, wireless masts and other accessories are placed far over at one side, to leave the deck clear. Huge freight elevators lift the planes from the hangar deck below, bringing them up through great trapdoors, completely assembled and ready to fly. Below this deck is an airplane factory and machine shop, capable of rebuilding an entire plane, or making any necessary repairs. Even the lifeboats and tenders have been moved from their davits and are carried slung in recesses along the side of the hull in the "Lexington" and "Saratoga."

Though they officially rank as aircraft carriers, both vessels are well armed, with double turrets fore and aft, so that they are capable of standing off an attack by destroyers or fast scout cruisers.



Courtesy London

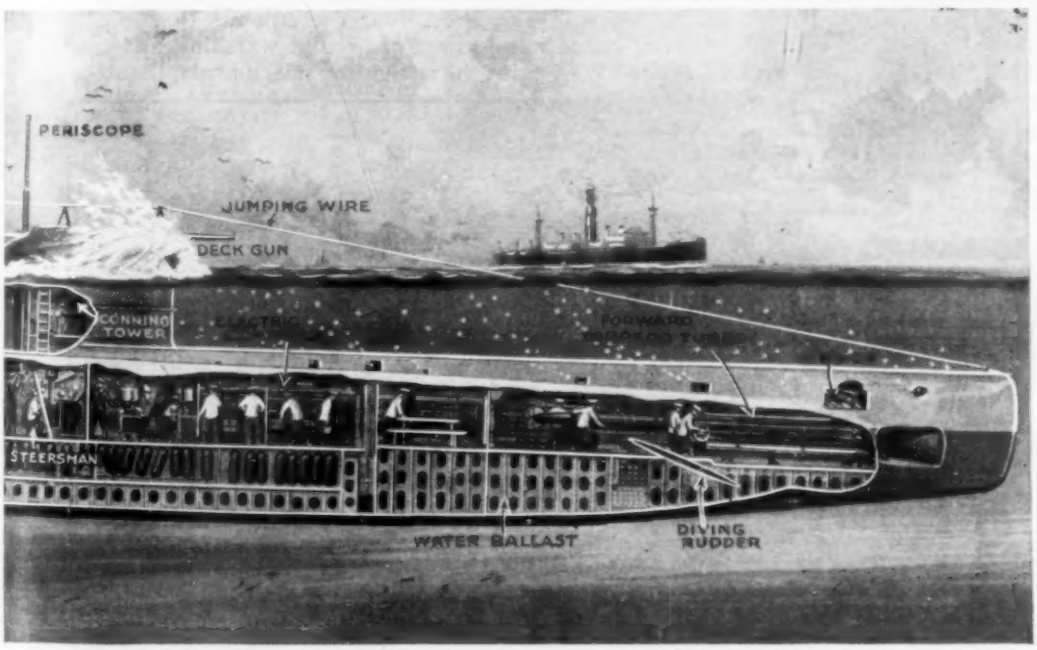
Cross Section of a British Submarine in the Act of Diving, Showing the Entire Crew at Stations, the Diving Rudders Set to Force the Ship Down and a Torpedo Being Shoved into Its Tube

While the aircraft carriers have been building, the rest of the fighting fleet has been modernized and equipped to withstand attack by hostile airplanes. Greater deck armor to resist bombs dropped from above, bigger and better anti-aircraft guns, replacement of the old-style basket masts with trimmer, more efficient-looking tripods supporting the conning towers and the fighting tops, the range-finding compartments, gun-control rooms and other superstructures, are some of the changes being made, along with elevation of the guns to permit firing at a higher angle and, therefore, at considerably longer distances.

The new British and Japanese battleships, however, show to an even greater degree the lessons learned at Jutland. While naval critics still disagree as to who won that battle, even the most partisan British writers have admitted that the German fleet apparently had better fire control. In the "Nelson" and "Rodney," and in the two Japanese ships, greater attention has been paid to the superstructure, which houses the eyes of the ship, and, in doing so, some of the supposedly basic rules of naval architecture have been cast by the board.

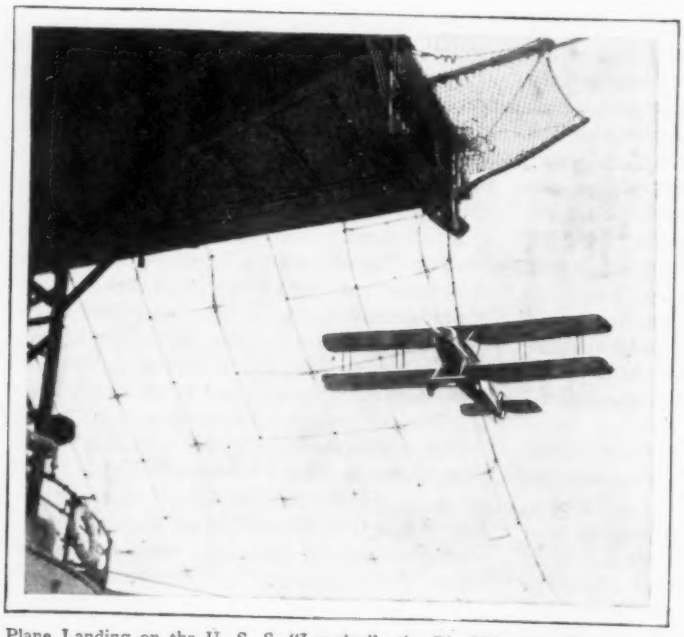
The two British ships are surmounted by eight-story armored towers, as big as an eight-story apartment house, and presenting an equally good target to the enemy. To protect such a tower from being blown to pieces, the ship carrying it must be faster than anything it meets and its guns must have a longer range. The American naval experts have not yet accepted the armored-tower idea, and it remains to be seen, when new battleships are built after the Washington agreement expires in 1931, whether they will follow the British and Japanese lead.

Since long before the time of Capt. Mahan, U. S. N., who wrote the book that still remains the leading textbook of sea fighting, it has been an axiom of naval strategy that the best defense is a strong offense. The "Rodney" and "Nelson" are the last words in that theory, for they are built to make an attack and not to run away. Their heavy batteries, nine sixteen-inch guns, are concentrated forward in three triple-gun turrets, while the stern is protected only by six pairs of six-inch rifles,



Illustrated News

This Is a Composite Picture of Boats of Various Types and Does Not Reveal the Secrets of the Latest Big British Submarines; Note the "Jumping Wire" to Clear Submarine Nets

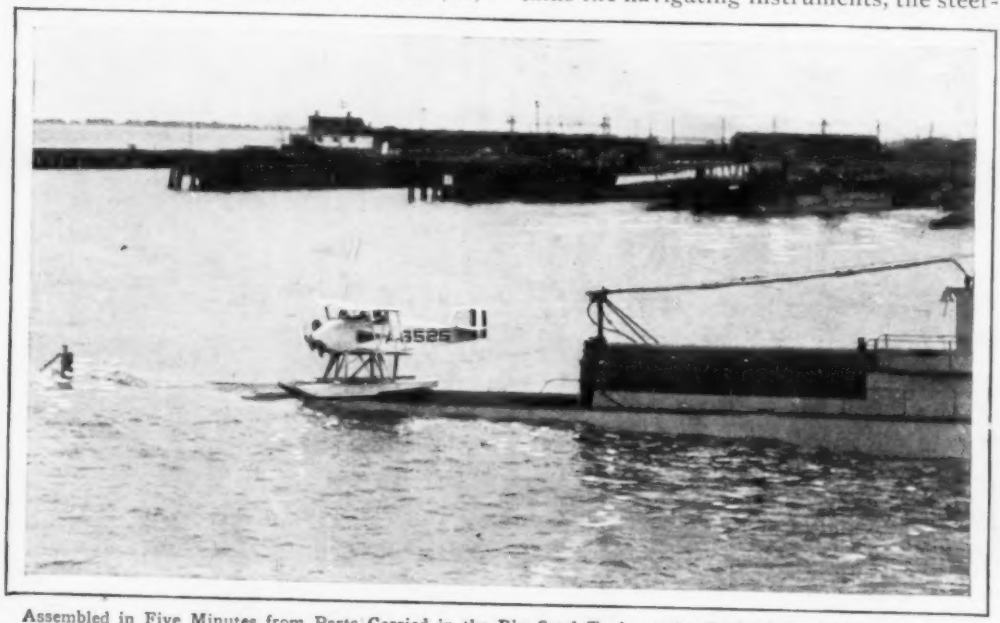


Plane Landing on the U. S. S. "Langley"; the Big Wire Net Protects the Lower Deck, and the Small Net Is for the Landing-Deck Crew to Dodge Into

mounted in three pairs on either side, to keep off the destroyers and scout cruisers which might attempt to harry the stern and sides. With a length of 702 feet, a beam of 106 feet, and carrying a crew of 1,300 officers and men, the "Nelson," first of the pair commissioned, cost about $35,000,000. Her decks are protected with a bombproof coating of hardened steel. Internal bulkheads and walls and external blisters, or torpedo bulges, enable her to withstand the simultaneous shock of four torpedoes exploding at the same time.

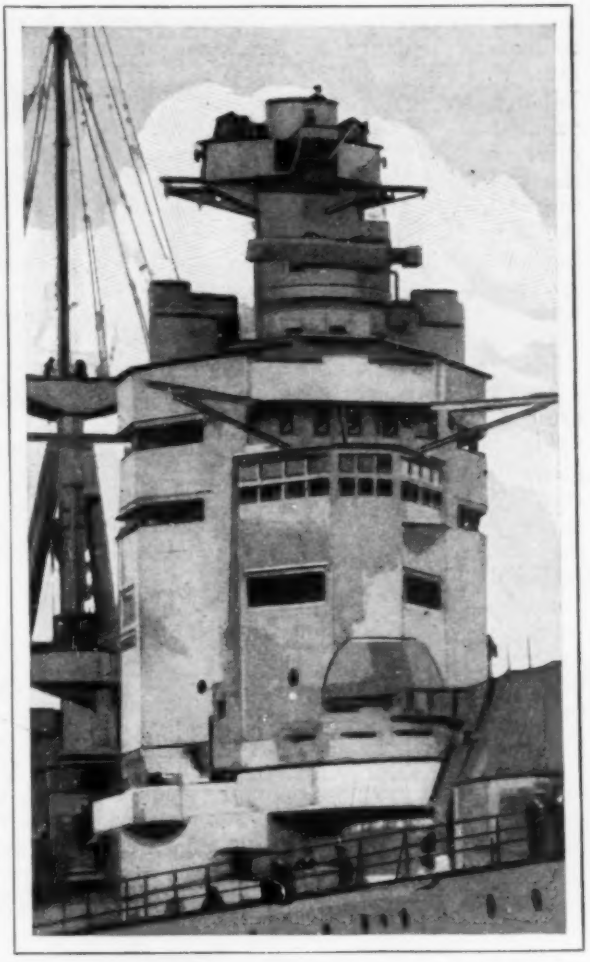
A single funnel, behind the armored conning tower, serves all her boilers. Behind it is a single mast, a tripod supporting a single pole, while four horizontal arms, stretching out, from the tripod top carry the ends of a maze of vertical wireless aerials.

It is in the armored tower, however, that the interest of naval designers centers. The first two of its eight floors provide sleeping quarters for the officers and men who must be constantly within reach of the control compartments. The third floor corresponds to the conning tower of present warships, and contains the navigating instruments, the steer-



Assembled in Five Minutes from Parts Carried in the Big Steel Tank on the Deck of the Submarine "S-1," This Tiny Plane Is Ready to Take the Air as Its Mother Ship Submerges

ing wheel, engine-room telegraphs, and signal systems, telephones and loud speakers communicating with every part of the vessel. The next story is for the captain, navigator and their telephone operators and messengers. Above them is the signaling position, wireless and radio-telephone operators. Next come the gunnery assistants, who work out the necessary paper calculations to regulate the gun fire. The main calculating station, receiving telephonic reports from aloft, is protected far below the water line. The seventh story of the tower is set aside for the officers and men whose duties require a full view around the horizon, so that they can instantly calculate the position, course and speed of the enemy ship. The topmost floor houses the fire directors, and, in the new British ships, a single telescopic sight in the direction station may be trained on the enemy, and, through electrical connections, it automatically lays every gun on the target, while the fire director, by pressing a button, can fire the entire broadside at the mark. The gunners themselves may never see the target, and have nothing to do but load the gun, clean and reload, while the observer far overhead does the actual directing and firing.



Eight Stories High and Violating, Because of Its Vulnerability, All the Accepted Rules of Naval Architecture, the Armored Control Tower of the "Nelson," England's Newest Warship, and, with Her Sister Ship, the "Rodney," the Biggest Battleship Afloat

The "Nelson" and "Rodney" represent what can be done within the present limitation on size, but, unless the disarmament treaty is renewed or extended in 1931, there is no limit to what may be done in the future. Ships of 60,000 tons instead of the 35,000 of the two British battleships and the 41,000 tons of the battlecruiser "Hood" are quite feasible. With that extra weight, immensely heavier deck armor to resist aerial bombs, side armor to withstand gun fire, and underwater protection against torpedoes are quite possible. Such a ship would cost so much that the price would be prohibitive to all but the most wealthy nations—in fact cost is the only limiting factor, outside of disarmament treaties—on the development of a navy that could withstand aerial, surface or sub-sea attack.

Naval constructors, however, are considering the possibility that the next war will introduce weapons unused in the last one. Poison gas, for example, was not tried at sea, despite the fact that the ability of a fast warship to maneuver to windward of the enemy renders it quite easy to lay down an invisible screen which would be carried downwind with disastrous results. To meet the threat of such an attack, ships are being equipped with powerful air fans, capable of directing such a blast against every opening in the hull that gas fumes could not enter. Such

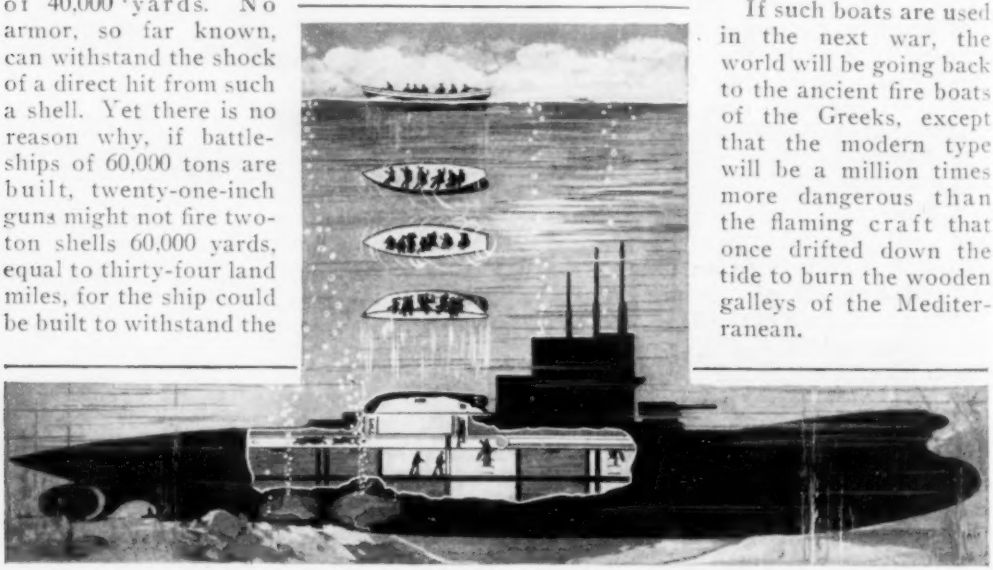
fans already are in use in the gun turrets to prevent the dangerous flarebacks which some times wipe out an entire gun crew. When a gun is fired, it leaves an enormous vacuum about the muzzle, as the air is driven away by the expanding gases. If the breach is opened quickly, the air, rushing back into the void, may sweep down the barrel and carry particles of smoldering powder bags back into the turret, to ignite the powder which has been hoisted up for the next charge. The powerful ventilating fans are designed to prevent anything blowing back into the turret.

The future battleship may replace the present airplane catapults with an all-over flying deck. The "Lexington" and "Saratoga" designs, with their four gun turrets, approach the combination aircraft carrier and battleship. The flying deck may possibly be armored with two or three inches of steel to resist thin-walled aerial bombs. Below it, the protective deck would be heavily armored, as at present, to stand off plunging shell and penetrating bombs. The turrets would be placed on this deck, firing from beneath the flying deck above.

Such ships may be called on to meet more powerful weapons than anything yet used in battle. The modern sixteen-inch gun can fire a one-ton projectile a distance of 40,000 yards. No armor, so far known, can withstand the shock of a direct hit from such a shell. Yet there is no reason why, if battleships of 60,000 tons are built, twenty-one-inch guns might not fire two-ton shells 60,000 yards, equal to thirty-four land miles, for the ship could be built to withstand the shock of the recoil of even such an enormous gun. The higher control towers make it possible to sight the enemy at these great distances or fire could be controlled from airplanes flying overhead.

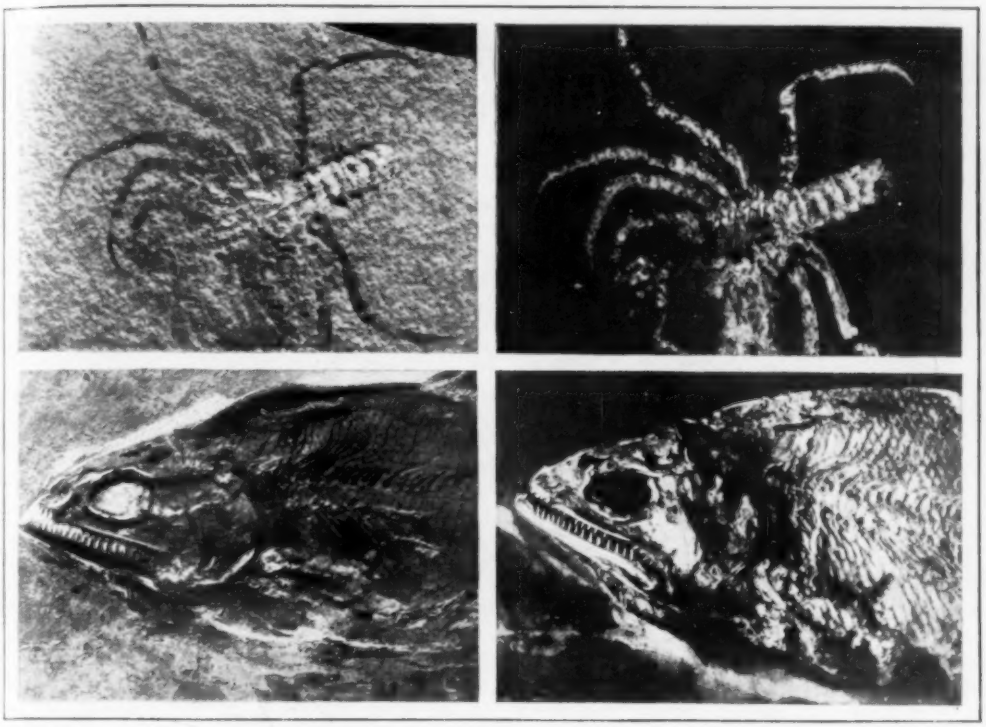
The torpedoes used under water in the World war were mostly of the twenty-one-inch class, but already thirty-two-inch torpedoes have been built and tried, and forty-inch ones are quite feasible, carrying correspondingly heavier charges. Such a mammoth projectile would pierce any present underwater armor. If the blisters and other protective devices are increased to offset the bigger torpedoes, it is possible to replace them entirely with high-speed motorboats, carrying a ton or more of explosive in the bow, controlled by radio and moving so rapidly and presenting such a small target that they would be practically immune from gun fire. Such boats have been built and successfully tested by several navies. In some ways, they are an improvement over torpedoes, for the latter, once fired, are out of all human control, and an error of minute proportions at a distance of several thousand yards is sufficient to make them miss the enemy ship entirely. The surface boat, radio-controlled, could be turned to meet every twist and turn of the enemy and guided visibly to its target.

If such boats are used in the next war, the world will be going back to the ancient fire boats of the Greeks, except that the modern type will be a million times more dangerous than the flaming craft that once drifted down the tide to burn the wooden galleys of the Mediterranean.



New German Plan for Saving a Submarine's Crew When Things Go Wrong: the Inclosed Lifeboat, Carried on Deck, Lifts the Men to the Surface, Turns Over, and Then Is Opened to the Air

INVISIBLE LIGHT REVEALS SECRETS OF FOSSILS



At the Left, Photographs of Fossils as They Appear in Natural Light, and at Right, under the Ultraviolet Rays; Structures Hardly Visible in Ordinary Illumination Are Clearly Revealed

Scientists now have a wonderful tool for studying fossils in ultraviolet light, invisible to the eye but effective in revealing structures that would escape ordinary observation. The secret of the light's action lies in its play on the material of the fossil. This it renders fluorescent but has no effect on the stony background, so that the fossil stands out with clearness, its character is more fully shown, especially the inner structure, and imitation fossils can be detected. It is believed that traces of organic material in the formation produce the glowing outlines under the impact of the light. Shortly before his death, the late Prof. Adolphe Miethe opened up a way for using the invisible rays by developing means for photographing the fossils when exposed to the ultraviolet radiations. A new filter material had to be found, as those first tried allowed rays to pass that obscured the photographically active ultraviolet rays. A prismatic glass vessel, containing a special solution, was inserted behind or in front of the objective during the picture-making process, causing the rock to appear clearly and the fossil to stand out in all details. Traces of dust, fingerprints, and other features invisible to the unaided eye, were plainly distinguishable in the developed plate, so that the utmost cleanliness had to be observed. Scholars believe that the method will enlarge the field of investigation with respect to fossils and bring to light many facts which have heretofore remained hidden because of the impossibility of more thorough study of the specimens.

SOAPSUDS EXTINGUISH FIRES OF OIL OR GASOLINE

One of the Berlin fire-engine companies is equipped with a soapsuds-generating unit to combat oil, gasoline and other fires. Powdered soap and water are mixed in large quantities and with great speed, the capacity of the apparatus being 8,000 quarts of suds per minute. The preparation smothers the flames.

GAUGE SHOWS PEP OF STUDENTS IN GYMNASIUM SCHOOL

© Keystone

Jumping against the Special Scales, to Register Force of Her Leap and Give Measure of "Pep"

Young women attending an eastern school of physical training undergo an interesting muscular-energy test to show their fitness for special work and their general condition. The subject stands under an indicator, with a movable disk at the top, and jumps. As she does so, the disk is pushed up and held there by a locking mechanism. On the basis of the height to which the gauge was raised, the examiner is able to gather data as to the strength of the subject's legs and toes and her vitality with special relation to her weight.

UNTUNED PIANOS CAUSE LOSS TO STUDENTS

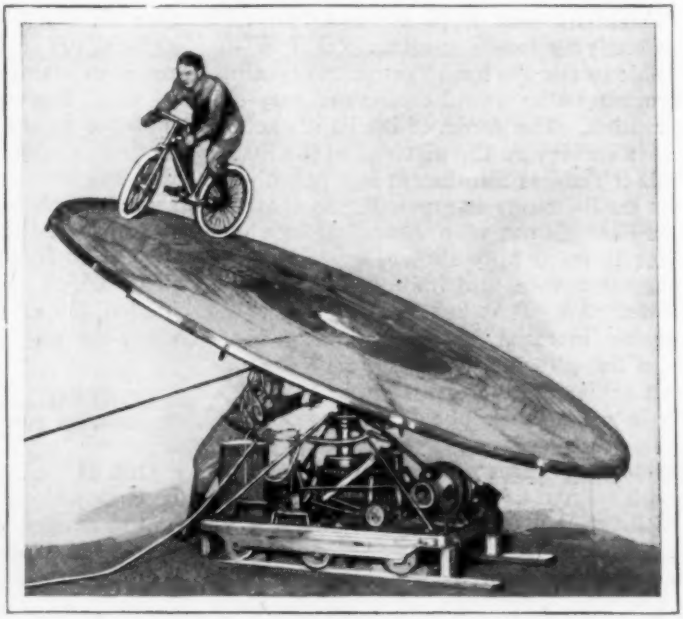
Eight-tenths of the pianos in this country are always out of tune, according to the president of the national association of piano tuners, with the result that many thousand dollars of the $900,000,000 spent annually for musical education, are wasted. He explains that, when the instrument is out of tune, the student's ear is likely to be harmfully affected.

ROBBING OF THE "SAFEST SAFE" PUZZLES LONDON POLICE

London's safe in the wall, a strong box on the exterior of the Golders Green hippodrome, was robbed of $1,500 recently, presenting detectives with a puzzling problem and somewhat disturbing the faith of its owners. Being exposed to constant view, it was supposed to discourage thieves, but apparently they found a way to disguise themselves as theater workers and evidently used a skeleton key, or a duplicate of the real one.

BICYCLE RIDE ON WHIRLING DISK LATEST STAGE THRILLER

One of the most recent theatrical novelties presented in Germany involves a feat of bicycle riding on a swiftly turning disk, pitched to a steep angle. The rider must maintain careful balance, while timing his speed to the disk's.



Riding the Whirling Disk; the Cyclist Must Keep His Balance on Steep Incline, While Pitting His Speed against That of Platform

With the FIRE PATROL

By PAUL PADDOCK

SEVEN men dash up a flight of stairs, pry the stop strip off the jamb of a locked door and burst into a room piled with furniture and boxes. In one corner, behind a glass partition, an overhead sprinkler is gushing. A man darts under it, gives a quick twist with a pair of tongs and the flow ceases. Three men climb to the top of a tall rack and cover it with big widths of canvas.

"Get help," shouts the leader. "Call three companies." Another man runs to a fire-alarm box, opens the inner door and taps a little key. First, the number 212, once repeated, the call for the fire department, then 26, also repeated, the number of the box, and then 183, the last digit being the number of companies wanted. Back comes the tick 2212, the department's O. K. signal.

Drillmaster Edward Reilley consults his stop watch. "Four minutes even," he announces. "Not bad; the record is 3.29."

You are watching Company Five, of Chicago's fire-insurance patrol, the water fighters, at drill in one of the queerest schools in the world, the first and only one of its kind.

Here students are required to break in the door to get to classes, and hurrying through lessons as fast as possible is encouraged. The room's odd furniture is arranged to represent conditions that might be met at almost any fire. The problem is to shield everything in it with the canvas and rubber covers so that water could do little damage. The sprinkler was shut off at the head, for there was not time to look for the standpipe, and sending in the alarm correctly is an essential that every man must learn. Had the signaler made a mistake, it would have been detected on a receiving apparatus in another part of the building, and he would have been required to give the alarm again and correctly.

In the four minutes, you have seen the men spread nineteen covers, fourteen feet wide and nineteen feet long, each weighing about thirty pounds, arrange them so that they formed catch-alls between the piles of goods, basins capable of holding from fifty to sixty gallons of water, and fold the edges of the sheets in such a way that water would not run under the material. Just a few weeks ago, these

Down the Pole at the Gong; Like Regular Firemen, the Men of the Patrols Are Experts at Getting to Fires on Split-Second Schedules

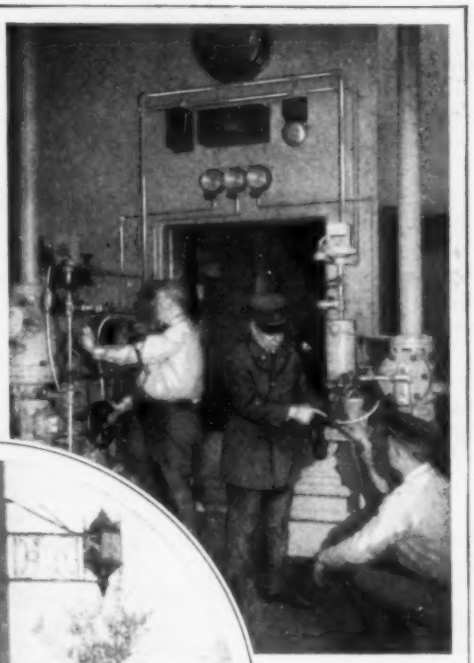
Where Students "Crash the Gates" to Get to Classes; Squad Using the Door Opener to Enter Drill Room

Drillmaster Reilley Giving Patrol Class Pointers on Chemical Extinguishers; How They Are to Be Used and Filled

Shutting Off Sprinkler at the Head, to Prevent Further Damage from Water

tactics and eleven covers saved $123,000 worth of silk from damage when a sprinkler broke in a department store. Last year, the city's nine patrol companies answered 14,013 alarms, traveled 37,546 miles and spread 22,053 covers at fires involving nearly $500,000,000 in insurance.

Firemen try to beat the fire, but the patrols must beat the firemen, to get their covers down before the hose is turned on, for water, when it has spent its force against a blaze, often causes serious damage. The patrols are maintained by the insurance companies, two per cent of the premiums going to their upkeep. The service is the constructive, salvaging branch of the fire-fighting game. The work of the patrols begins when the fire starts and often does not end until long after, for goods must still be protected from the weather and other damage when the blaze is extinguished. No charge is made for the work either to insured or uninsured. Besides protecting and saving property, the patrols render first aid to the injured, assist in rescue duty, and often their chemical equipment puts out a fire before the arrival of other apparatus.



Learning How to Control the Wet and Dry Sprinkler System, the Patrol Car Answering a Call, and the Watch on Duty

The men are picked for their speed, skill and courage. The water fighters work under the fire, where ceilings are likely to collapse. It is a department tradition never to pull the covers until necessity demands. The sheets cost about $1 a pound and the stuff under them may be worth millions. Hence, the men of the patrols are among the first to enter and the last to leave a burning building, often remaining until flames show through cracks in the walls and smoke is threatening suffocation. Just the other day, five men were killed in New York. Piles of rags soaked up tons of water on an upper

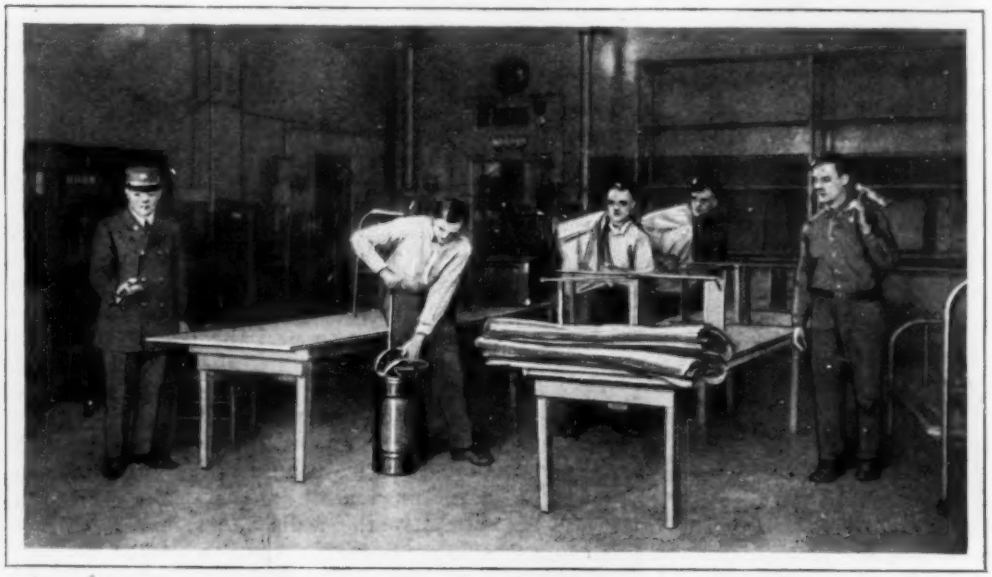
floor. Under the unexpected weight, the supports gave way and the load buried men, covers and all.

Not long ago a Chicago company escaped death by a matter of seconds. They were on the fifth floor, the fire was on the sixth. In some mysterious manner, it got under them on the fourth. "Gee, it's hot coming up those stairs," a fireman remarked. The chief, warned of the peril by the chance word, investigated and ordered the men out just as the flames broke in on the fifth floor. Recently another company won honors for quick action in a life-saving emergency. A woman was balancing on a fourth-floor ledge, determined to jump, although no net had been spread. Grabbing one of the big covers, the patrol company held it tight and she leaped. The canvas didn't hold her, but broke the force of her fall sufficiently to prevent serious injury.

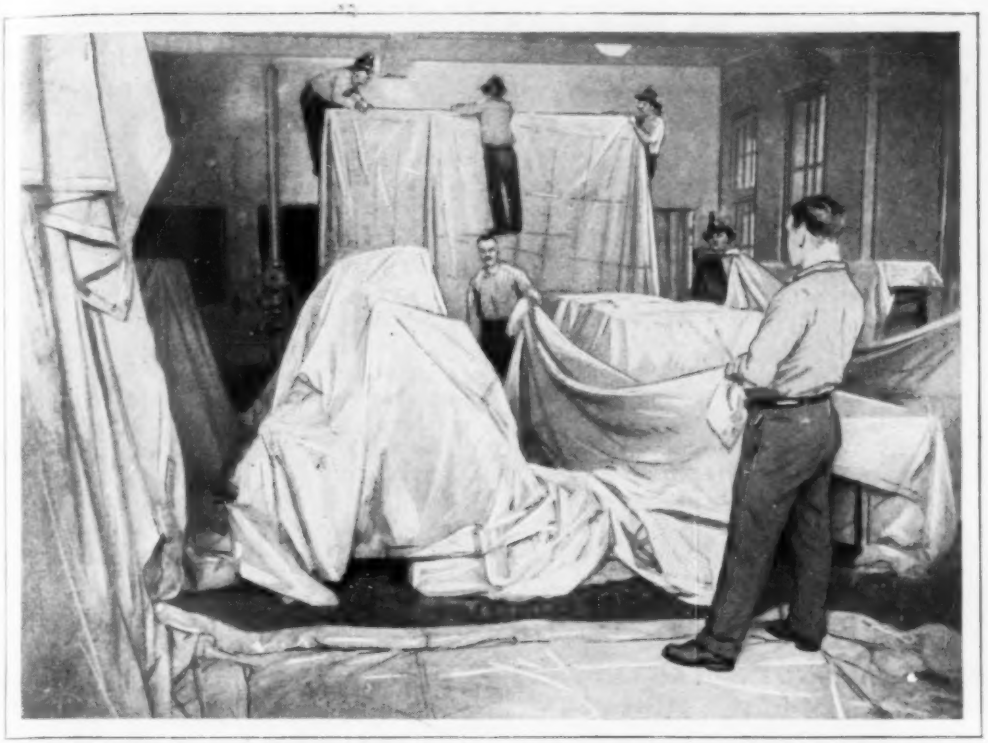
Fighting water requires special strategy and, for that reason and as the result of years of observation and experience, Chief Frank C. McAuliffe, former battalion chief in the Chicago fire department, decided to establish the school where men, entrusted with the task of saving millions of dollars worth of property yearly, could receive training under conditions as nearly like those of an actual fire as possible. The classroom is in a building recently erected by the board of underwriters. It is completely equipped with fire-signal and receiving instruments, wet and dry sprinkler systems, the latter operating with compressed air so that water will not have to be kept in pipes exposed to freezing, sprinkler-control units and various kinds of chemical extinguishers.

Arrived at a fire, the patrol-company captain must be able to size up the situation instantly. Shall he call for more help? What kind of a building is it, sturdy or flimsy? What's on the upper floors, heavy machinery, stoves or other articles likely to come crashing down if the lower supports give way, or is there reasonable safety of load? What kind of stock is in the structure? Where is the fire now and where is it likely to spread? How many lines of hose will probably be played? Are dangerous chemicals stored anywhere? Does any part of the building need immediate ventilating? These and scores of other questions must be answered almost instantly, for a few seconds may mean loss of life and property.

Of all types of blazes, the patrols dread those in bowling alleys most. There is much space to cover and complete protection is difficult. A stock of stoves is hated for two reasons: If they are on an



Leaving the Classroom after Drill; Chief Reilley Has Timed the Squad with His Stop Watch, Covers Have Been Folded Up and the Men Are Now Ready for First-Aid Practice



Spreading Covers in the Drill Room; Boxes and Articles of Furniture Are Arranged to Represent Conditions at an Actual Fire; the Object of the Practice Is to Robe Everything in Waterproof Tarpaulins and Rubbers

upper floor, they peril men below them and sharp edges are likely to tear the covers. In a residence fire, extreme care must be taken in piling furniture for adequate covering and handling costly pictures and bric-a-brac that may represent fortunes in insurance. Skyscrapers of modern type are protected against fire, but water damages things in them as well as in frame houses.

To enter the patrol-training school, you must be between twenty-one and thirty-one years old, five feet seven inches tall, or more, and weigh at least 145 pounds. After qualifying, men are placed on probation for six months and then, if they have fulfilled requirments, they become full-fledged members of the patrol.

PLANE GETS NEW PARTS IN AIR BY DARING TRANSFER

Refueling airplanes while they are in motion has been done successfully for some time, and now the moving repair station is seen as a possibility as a result of an interesting incident near Luke field, Hawaii. An army bombing plane had taken the air when it was discovered that the landing gear had been damaged. The pilot then dropped a note, asking that repairs be sent up. A service plane with the desired equipment was dispatched. After a vain attempt to transfer the parts by rope, the two planes were guided close together and, while one man clung to the tip of the bomber's wing, the repairs were handed to him by a lieutenant in the smaller plane, who also had crawled far out on the wing of his machine. Efforts were then made to fix the landing gear, but failed. The bomber was started for a water landing. One of the motors was stopped when a parachute became entangled in the propeller, and the plane dropped with considerable force, throwing its occupants into the water, but they were not injured

¶Arctic fur seals have been found in the antarctic regions, showing that they are among the greatest rovers in the world.

Robbing the Walnut Harvest of Its Most Unpleasant Feature, Removing the Hulls in Motor-Driven Machine

BLACK-WALNUT HUSKER CLEANS BUSHEL IN FIVE MINUTES

Utilization of thousands of bushels of black walnuts, now wasted every year because of the expense of removing the hulls, is seen as a result of the introduction of a motor-driven husker. It is said to clean a bushel in less than five minutes, turning out each nut as bright and clean as though it had been scrubbed with a brush. The huller is made in various sizes and running water is used for cleaning. Walnut culture is being urged because of the food value of the product and the ease with which the nuts can be grown. The trees thrive in low land unsuited for other crops on account of drainage problems and the likelihood of floods. In the so-called Corn Belt, it is estimated that there is enough land to make a state half the size of Illinois or Iowa, which is now a waste, although rich, level and fertile, but would be excellent for walnut culture.

SCARCITY OF CHROMIUM IN U. S. HANDICAP TO INDUSTRY

Although the United States is the largest consumer of chromium in the world, this country produces practically none of the metal, being dependent upon South Africa, Asia and New Caledonia for most of its supply. In 1926, 200,000 tons were imported. For the manufacture of certain steels, there is no known substitute. It produces a hardness and toughness extremely desirable in some grades of steel and is also used in rustless and stainless steel and in special alloys. In case of a war, or other emergency shutting off the traffic in chromium, the United States would face a problem, as the reserves would last but a short time, experts declare. The metal is not found in the free state in nature, at least in commercial quantities, being derived from chromite.

WOLF HUNTER'S AUTO CARRIES KENNEL FOR DOGS

Speeding over the plains in his specially equipped automobile, Charles Cummings of DeSmet, S. Dak., makes vigorous warfare against the wolves that menace live stock. In the rear of his car is a kennel for his hunting dogs. A release, controlled from the driver's seat, allows them to jump out, and a loud fire siren is used to scare the wolves from their hiding places. Last winter, Cummings and his dogs killed 151 wolves, netting him $1,800.

How the Auto Helps the Hunting Dog; Special Car Which Carries Dogs in Rear Compartment for War against Wolves in West

"BOOKS" IN STRANGE LIBRARY ARE BOTTLED SOILS

Much of the Earth Is Represented in This Room, the Government's Soil Library in Washington, Where Samples of Dirt from All over the Globe Are Indexed after Tests

Fifty thousand bottles of soil, the world's largest collection of such material, fill the shelves, cases and compartments of Uncle Sam's strangest library. These carefully identified and indexed specimens include every type of earth known to science. Soil explorers have braved the hardships of the wilderness and bandit-infested lands in procuring material. Agricultural specimens of the earth's crust have been secured in South and Central America, Cuba, Europe, Australia, Russia, Africa, Asia—and where not. Naturally, you will be amazed to learn that our government has mapped and tested 4,053 different varieties of soil in the United States. One thousand of these soils are important in our food-producing economy. A great soil map of the nation, which will classify every square inch of land surface, is now being made at a cost of many million dollars. Standardized and systematized farming results from this soil research. Farmers who move to new localities have only to study the maps to find out what crops are the most profitable.

BURRO AIDS IN TAMING HORSES ON MEXICAN BORDER

The easy-going burro of the Mexican-border country is being used successfully by farmers in taming wild horses. The trick, said to have been invented by Mexican truck growers, involves yoking the horse and the burro together with a strong rope or chain and letting the animals wander at large. The wildest animal of the range will wear itself out within a few hours, owing to the obstinate character of the donkey. South of San Antonio, the method has developed to a fine point. After a few days of companionship with the docile burro, the horse is so tame that it may be harnessed to a wagon or plow.

¶The temperature of water at hot springs is seldom above boiling.

MOTOR ROCKER FOR BABY BUGGY SAVES MOTHER'S TIME

Rocking Apparatus Installed under Baby Buggy and Connected to a Lighting Socket for Operation

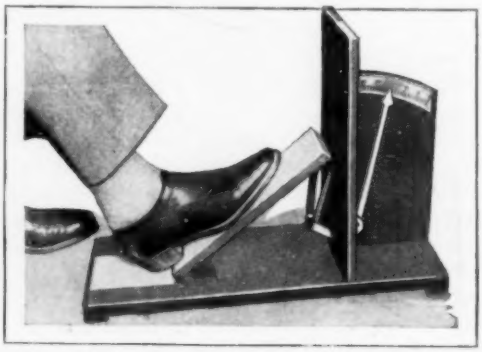
Rocking the baby by motor is now possible in an attachment fitted to the carriage. It rocks the body of the buggy from side to side and also rolls the entire vehicle alternately forward and backward. Controls are provided for regulating the action and, once started, the outfit requires no attention.

FIRST THERMOMETER A TOY DEVISED BY GALILEO

Like many important inventions, the thermometer, one of the most useful of man's appliances, had a humble beginning. Galileo is credited with devising the forerunner of the modern instrument. It was simply a glass bulb containing air and connected to a glass tube of small bore which dipped into a colored liquid that rose or fell in the tube according to temperature changes. The gauge had no scale and was regarded merely as a scientific toy, one of Galileo's numerous playthings of a like nature. Later one of his pupils, Francisco Sagredo, substituted wine for the colored liquid and a member of the faculty of the university of Padua, realizing that Galileo's toy had great possibilities, adapted it to the measurement of the heat of the body, so that fevers could be detected. Between 1630 and 1640 the grand duke of Tuscany made still further improvements, hermetically sealing the open end and partly filling the tube with alcohol. In 1714, Fahrenheit instituted the scale which is in use at present, marking thirty-two degrees as the freezing point and 212 as the boiling point of water. Many reasons have been given as to why he chose to graduate his scale between the freezing and boiling points into 180 divisions, one being that since he was a maker of astronomical instruments, the division followed the principle of a marking by degrees, 360 for a full circle and 180 for a half. The Reaumur thermometric scale, designating the freezing point at zero and the boiling point at eighty degrees, was invented by a French scientist of that name, in 1727, and Christin, of Lyons, revised the scale proposed by Anders Celsius, in 1742, to make the present centigrade division.

GAUGE MEASURES FOOT ACTION TO TEST AUTO DRIVERS

How the feet behave under excitement is told on a gauge German examiners are using in testing candidates for automobile drivers' licenses. It shows the pressure exerted in varying degrees of emotional disturbance, indicating how the subject would control brake and accelerator under different situations while driving a car.



Gauge Used in Testing Foot Action of Automobile Driver License Candidates

Silvery Sardines in Basket Loads Are Swung Aloft and into the Cannery When the Fishing Boats Come into Port with Their Catch, Often Running into the Millions

Putting the Can around the Sardine

How Smallest Fish Taken Commercially Is Caught at Sea During Night in Lakes of Cold Flame

By H. H. DUNN

MORE than 300,000,000 pounds of sardines were taken from the Pacific ocean last year. Their value was close to $12,000,000. Though this is the smallest fish taken commercially, it furnished more than three times as much, in both weight and value, as any other food taken from the ocean on the western coast of the United States.

The business of taking these uncounted millions of sardines, cooking them and putting them into tin cans so that they may be shipped and sold all the way from San Francisco to Shanghai and from Medicine Hat to Buenos Aires, occupies the time of more than 12,000 persons, and it is conservatively estimated that 50,000 depend on the industry for their livelihood. More than 1,000 boats are engaged in the capture of the sardine, and fifteen packing plants prepare him—or her—for the distant table. Seines used in harvesting this sea food, if woven into one huge net, would surround a school of fish twelve miles in diameter.

From the time he is lifted in a great lampara net, or a purse seine, from the Pacific, until he appetizingly appears on the table, the sardine is the hero of a double romance—of the sea and of modern mechanical industry. Particular types of boats, special seines and peculiar methods

Fishermen's Harbor in San Francisco a Quarter of a Century Ago When the Motorboats, at the Right, Were Just Beginning to Replace the Quaint Craft with Lateen Sails at the Left

of fishing have been developed to get him out of the sea. Equally specialized machinery has been built to get him into the can, and the government of a state has set all its legal machinery in motion to give Sir Sardine such protection that he may remain forever a source of millions of dollars annually to the commercial fisheries of California.

Since the first step in canning your sardine is to catch him, let me take you on "Lina," a modern "sardiner," built last winter, on one of several all-night voyages after a few tons of the little fish.

For some reason not well known, the bigger schools of the larger sardines come to the surface, and also swim closer inshore, during the night; therefore "Lina," captained by Pete, engineered by Gus, and crewed by four fishermen, with myself as supercargo, put out from Monterey on a night in January. "Lina" is of the type known as "Japanese boat," because first developed in the California fisheries by the Japanese, but later improved by Austrian, Scandinavian and American boat operators. "Lina" is forty-eight feet long, about twelve feet wide, draws five or six feet, and is driven around twelve miles an hour by a Diesel engine. She has the sheer to be a "dry ship," no matter how heavy the water runs, and the wide tail to help lift her clear of following seas. Spotlessly white as a private yacht, save for a green stripe along her gunwales, the only dark blot on "Lina's" hull was the lampara piled in her stern. This seine, 400 fathoms long by thirty fathoms wide, with a heavily woven pocket, or "bunt," at the middle of its length, where the sardines at last are caught and held, was bone-dry from two days in the sun, and coiled so as to run as easily from the stern as a cowboy's "rope" is running from the loop in his hand.

As we set "Lina's" nose steadily westward, I learned from Pete that smelt and anchovies can be distinguished from sardines—while still in the water—by the manner in which they swim away from the approaching boat. The smelt swims in an undulating course, leaving a murky, wavering line of phosphorescence; the anchovy, a weak swimmer, makes short, curved dashes, while the sardine swims swiftly away in a strong, slightly bent path of glowing water, reminding one of a submarine rocket. In the daytime, the fishermen locate the schools of fish by the clouds of seabirds following them, but at

night the phosphorescent glow betrays their presence.

We went ahead for an hour, night becoming deeper and darker; then another hour, with all dimmed except the red, green and white riding lights. Ahead, in the bow, one of the crew watched the sea, and at the end of another half hour shouted back:

"Easy on the port!"

When it was pointed out to me by the sharper eyes of the lookout, I could see a dull glow on the ocean, an area as large as a twenty-acre farm, which seemed to be filled with smoldering fire. Then, as we drew closer, tiny flashes appeared, miniature cascades of liquid gold, where the millions of sardines leaped and played in their lake of cold flame. This phosphorescence is due to the presence of myriads of microscopic organisms, called dinoflagellates, which, when disturbed, give off a "frozen fire."

We maneuvered to the opposite side of the great school of fish, so that the wind might not blow the lampara back into the propeller of the boat. Once there, a skiff with two men in it was dropped and immediately steadied with a drag made by casting a ten-gallon keg full of cement and then knocking off the staves, an iron ringbolt having been sunk through the cement while the latter was soft. The free end of the long seine was taken into the skiff, and, with Gus at the wheel, "Lina" set out to surround such a part of the thousands of tons of swimming sardines as the lampara would hold. Then I realized that we had been running without lights the better to see the size and limits of the school.

Fisherman Paying Out the Enormous Net; Unloading the Catch into a Belt Conveyor at the Cannery, and, Top, Hauling In the Net

As we swung along the open-sea side of the school, Pete and two other men payed out the seine, seeing that it ran free from the table in the rear of the boat, and that the weighted side was down. When he came to the bunt which marks the center of the length of the net, Pete signaled to Gus, who brought the boat about and swung her back to the skiff, whose location was marked by a flashlight turned

on and off by one of the men in the small craft. As two men worked each wing of the seine, Pete, standing in the center of the stern, worked up and down a weighted board attached to some ten feet of line, creating such a splashing at the open end of the net that none of the fish escaped. The pulling became harder; the weight of the fish began to tell on the arms of even the husky four; and a fiery, agitated mass glowed in the water as the seething ball of sardines confined in the bunt approached the surface.

The wings having been dragged in, two men took turns shoveling the sardines up to the deck of the motor fisher, using specially devised scoops, made of strong webbing stretched on oval iron frames, with long wooden handles. Two other men, on the deck, with ordinary scoop shovels threw the sardines as far forward as possible. With the bunt emptied and the lampara repiled, the boat was again set on the trail of the moving lake of cold fire which marked the progress of the vast sardine school up the coast. Twice more the lampara was dropped over and hauled in, before "Lina's" deck was filled. Her cargo was a little better than ten tons.

On each trip to the cannery, the fish were unloaded by the simple process of shoveling them into elevators, in which they were carried to the scaling and washing machine, a long, revolving tube of heavy wire mesh. Thence, thoroughly drained of all water, fragments of seaweed and other debris, they were taken on automatic conveyors to the frying pans, distributed into these, and cooked in ovens for a fixed period. Thereafter they were placed in cans, passed for two hours through a temperature of 212 degrees, and finally sealed and inspected. Virtually all this work, with the exception of the inspection of the cans, is done by automatic machinery.

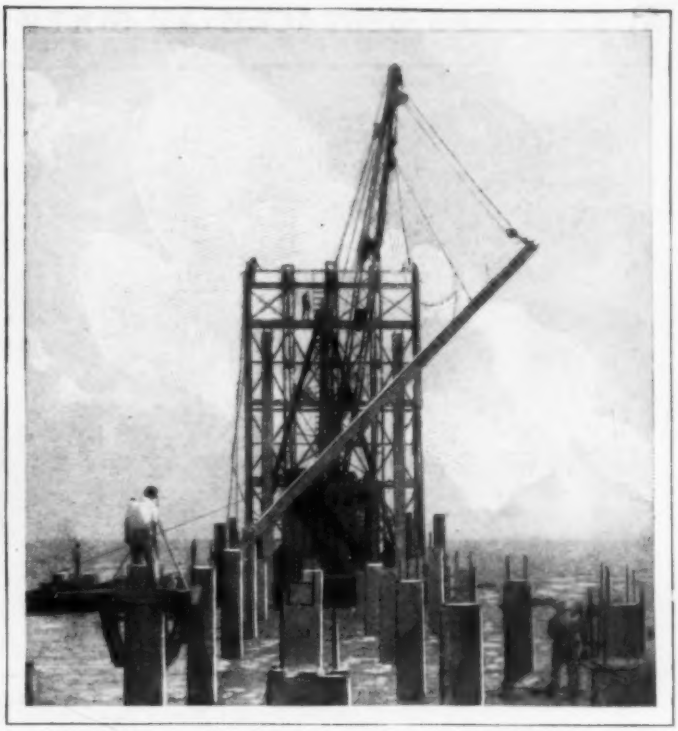
After the inspection, the labels are put on, also by machinery, and the cans packed in cases. Less than forty-eight hours after we had found the school of sardines, twenty-six tons of them were in the cans, ready for shipment to any point in the world for use as food.

KEEPING HOUSE IN SKYSCRAPER INVOLVES BIG TASK

Just to remove pencil marks and scratches from the offices and corridors of a New York skyscraper costs $27,000 a year. The owner of another building has spent $300,000 on the polished-marble

The Lampara, or Purse Net, Is Often 2,000 Feet Long and 150 Feet Wide, and the Services of Many Men Are Required to Handle It When Brought Ashore for Drying

wainscoting for the hallways, and it is estimated that simply keeping the offices clean takes about sixty per cent of the total outlay for maintaining big business structures in sanitary condition. According to one manager, taxes are the largest items of the many involved in operating and keeping up big buildings. The next is the daily cleaning cost, which is absorbed by armies of men and women hired to wash windows, wainscoting, furniture and other parts. Painting is a big expense in some structures. Among items that the average person does not usually consider in connection with the task of the skyscraper "housekeeper" are those of keeping up special hospital quarters in the building, and reading and writing rooms for business women. Many opportunities are offered for savings, one being the use of hardware that does not require polishing, and some builders have adopted unlacquered bronze and a special kind of cast iron as the most satisfactory finishes. Managers also must keep the good will of their tenants and, to that end, select building attaches who will display courtesy and efficiency.



Swinging Eighty-Foot Concrete Pile into Place for Driving; Part of the Equipment That Did Rapid Work on New Orleans Bridge

EXTRA AUTO-STEERING WHEEL PROMOTES DRIVING SAFETY

Reduction of driving risks is anticipated in a supplementary wheel on the steering post. It controls the headlight changes and the horn so that the hands do not have to be removed from the main wheel in making adjustments. The attachment was introduced recently in France.

GIANT PILE DRIVER DRIVES TWO AT SAME TIME

A mammoth pile driver, capable of driving two eighty-foot concrete piles at the same time, was used on the new highway bridge across Lake Pontchartrain, built to give New Orleans its long-desired outlet to the east and north. The bridge, which is approximately fourteen and a half miles long, required 2,800 concrete piles, two feet square and eighty feet long, driven to an average depth of fifty-seven feet. In order to rush the bridge through so that a continuous highway could be opened this year from Jacksonville, Fla., to San Diego, Calif., the big pile driver was built with four sets of movable leads, handling the piling for both sides of the bridge at the same time. Across the piles the thirty-five-foot bridge spans were laid at the rate of twenty a week, and a floating concrete mixer poured the highway deck at the rate of 400 cubic yards every eight hours.

¶Some clouds measure as much as ten miles in thickness.

AUTO JUMPS OBSTACLE AT SIXTY MILES AN HOUR

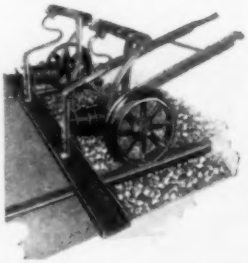
Try This in Your Car; Test with the Leaping Auto on French Roadway; Dashing up a Steep Incline, It Easily Cleared Another Car and Made a Safe Landing without Damage

For a motoring thrill and to test the springs and other parts of his car, a French driver demonstrated the jumping possibilities of his auto recently. At a speed of sixty miles an hour, the machine was driven up an incline and easily cleared another car by the side, rising to a height of more than ten feet. The landing was made without mishap.

WIRELESS FIRE ALARM HELPS PROTECT CITY

When a fire alarm sounds in Dallas, Tex., the signal is instantly recorded on radio-receiving sets installed in the chief's and other cars of the department, so that officials are immediately in touch with the central office. The receiver is constructed to react only to the wavelength of the sending unit, which is actuated through a relay connected with the fire-alarm apparatus. The transmitter is equipped with four fifty-watt tubes which are continually kept warm by a ten-volt current through a rheostat. When an alarm is sounded, this rheostat is cut out by a relay and the tubes get full voltage. Another relay starts the motor generator and a third operates the fire-alarm circuit to hit the number of the box. The generator is automatically released fifteen seconds after the fire-alarm system is quiet. Tests have shown that the installation is reliable at all times and requires practically no attention. It is the invention of Henry Garrett, Dallas superintendent of police and fire signals and a pioneer in the development of electrical traffic controls.

CEMENT TAMPER AND FINISHER SPEEDS PAVING



Work that ordinarily requires several men is quickly and efficiently done with a pavement-finishing outfit, recently introduced. It is pulled along on rails, tamping the layer of concrete below with electric-driven pounders and smoothing off the finer mixture that rises to the top.

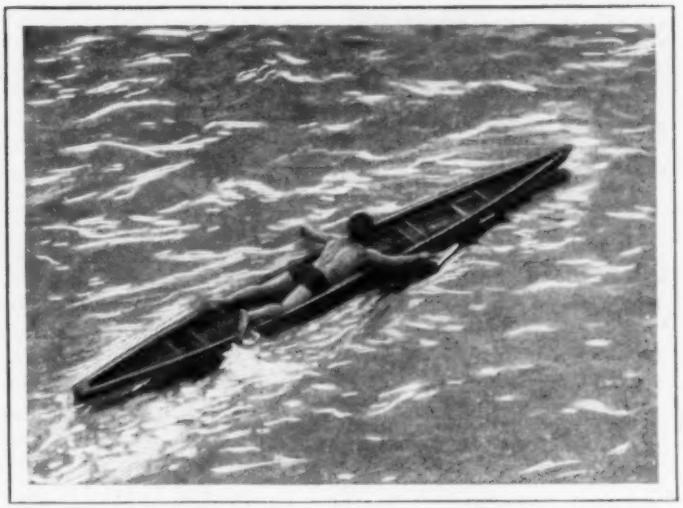
AUTOMATIC VALVE GIVES ACCURATE TIRE PRESSURE

A valve to fit the free-air hose and inflate tires to a predetermined pressure, eliminating guesswork and removal of the hose to test the air, has been invented. The valve consists of two cylinders, with a by-pass between them. The upper cylinder has a sliding sleeve, and is marked in pounds. To use, the sleeve is moved to the point where the figure for the desired pressure appears, and locked in place with a quarter turn. The device is then applied to the tire valve in the usual way, and passes air into the tube until the desired pressure is reached. At that point, any excess air is by-passed through the upper cylinder, escaping at the rear with a whistling noise to warn the user, and no more than the predetermined pressure can be put into the tire.

Air-Hose Valve That Automatically Fills Tire Only to Desired Pressure

POTATO ON IDAHO AUTO LICENSE BOOSTS STATE'S PRODUCT

Idaho automobile-license tags for 1928 will bear an embossed representation of a potato in natural colors against a green background, and the words "Idaho Potatoes" will appear at the bottom of the tag. This plan of advertising a state's leading product on the auto licenses was started by Massachusetts with the figure of a codfish on the plate.



Surf-Riding in the Hand-Propelled Canoe; the Slender Craft Is Easily Managed and Combines Features of Boat and Surf Board

TINY CANOE PADDLED BY ARMS FURNISHES SURF SPORT

Hawaiian surf-board experts have recently introduced a shell-like canoe paddled with the hands and arms for exercise and sport in the waves. It accommodates one person who lies prone with the arms extending at the sides. In calm water, considerable speed can be attained.

ELECTRIC BELT TO HEAT WATER STRAPS AROUND TANK

To maintain a supply of hot water for the home, an electric belt has been introduced in England. It is simply strapped about the tank and warms the water above it by heat caused by the resistance to the passage of the current through the conductor, which is adapted to 500, 750 or 1,000 watts. An asbestos-lined cover insulates the heating element, and if desired, two belts may be used on the same container to insure a more abundant supply of heat.

Injecting Charges of the Preservative in Timbers to Prevent Decay; Material Applied with Great Force

"VACCINATE" POLES TO CURE ROT AND PROLONG LIFE

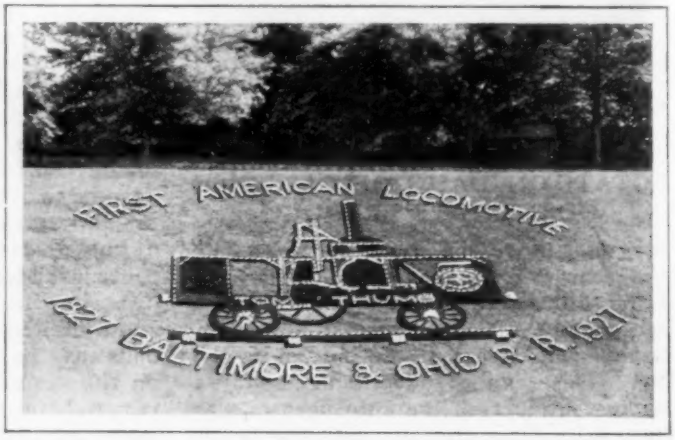
German chemists have developed a process for arresting decay in poles, posts and other wood products by injecting special chemicals under pressure. A first treatment is designed to kill fungus growths and the second, to provide an antiseptic against decay bacteria.

OLD ROMAN TREASURES FOUND UNDER BANK OF ENGLAND

Relics of the first city of London, connecting it to early Roman times, were discovered recently as workmen were digging in the soil twenty feet below the ground level, while making alterations in the Bank of England. Their picks turned up fragments of little cups, plates and bowls, manufactured 1,800 years ago and shipped to London in Roman galleys. The glaze was still bright in spite of the long period under the clay. There were also black and gray pottery and various metal and leather objects, well preserved. Among them were Roman sandals, that, oiled and cleaned, could be used again, for the leather regains its elasticity. Bone hairpins, with which the Roman women secured their hair, vinegar and salt dishes, a carpenters' folding rule and small spoons with a bowl at one end and a sharp point at the other, which was used to extract the meat of shellfish and open eggs, were among some of the other articles discovered. Fir-tree cones were also found. They were shut tight when removed from the soil but opened in the moist air. Discovery of the relics suggests that the site of what is now one of the most valuable plots of land in the world was a rubbish heap in Roman days. The district was evidently a marsh into which the housewives threw their broken pots. London was a Roman city for 400 years, but most of the objects found date from the first to the middle of the second century.

ENGINE IS PICTURED IN PLANTS FOR RAILROAD ANNIVERSARY

More than 26,000 plants of metallic colors were used in making a flowerbed design of the "Tom Thumb," pioneer American locomotive, for the centenary anniversary of the Baltimore and Ohio railroad. Hubs and wheels were worked in plants of a light shade, brass trimmings in yellow, and boiler, smokestack and other parts by a plant which turns almost black at maturity. The design was seventy-five by fifty feet in size.



Floral Replica of Pioneer Engine Celebrates Railroad's Anniversary; Plants of Metallic Colors Were Chosen

Tree Tops Protect the Turkey from Prowling Animals While It Sleeps, but Do Not Save It from the Thanksgiving Dinner Table and the Feather Fancier Who Seeks Its Plumes

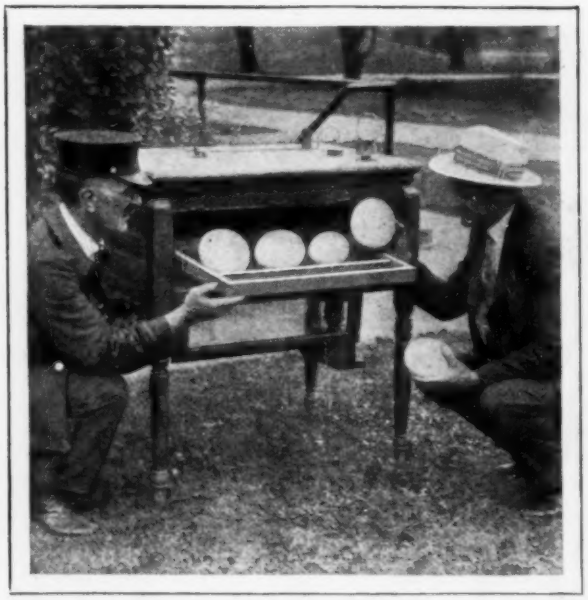
From Turkey Feathers to Ostrich Tips

Texas Gobblers Displace Lordly Plume Bearers When Feather Makers Find Way to Produce Imitation Decorations

TWO hundred thousand ostriches in a single South African district have been slaughtered recently because the disappearance of the hat plume for fashionable wear rendered the birds incapable of earning their keep.

At least that is the reason the ostrich breeders gave when they wiped out their farms, but a new American feather business credits the Texas gobbler for transferring the ostrich-plume business from Africa to the United States. For the feather dealers have found a way to make ostrich plumes from turkey feathers.

Before the Thanksgiving bird appears on the table, he has been divested of a side line of plumage which, divided and subdivided according to trade classifications, numbers more than fifty varieties. The short tail feathers are made into small dusters. The long wing pointers become arrows for the rapidly increasing sport of archery. The long tail quills are fashioned into fishing tackle. The heavy wing quills become feather boning for whips and riding crops. The soft body feathers are used in stuffing cushions and mattresses, or are exported for bedding to those countries which still cling to the old-fashioned feather bed. The soft down from hips or thighs becomes the "marabou" of commerce, for, contrary to popular belief, very little of that which passes in the feather trade for marabou is obtained, as is commonly supposed, from the tail or wing of the African stork. In fact, to quote one of the biggest distributors of feathers in the United States,



Officials of the Philadelphia Zoo Preparing to Hatch Their Own Ostriches in an Incubator

"There is not enough marabou grown in South Africa to supply one day's demand when the feather business is good."

As for ostrich tips, while ostrich fans and ostrich-plume trimming have for years had a certain spasmodic popularity, even in the days when ostrich fans waved furiously and every woman had at least one picture hat with its trailing plume, the ostrich was no diamond mine for its owner. It looks imposing in a circus menagerie or zoological garden, but as a bird of commerce, its feed bill is too high, its annual output of plumage too limited, and the bird itself too singular of purpose, to be a financial success. I asked Frank S. Foster of Peoria, Ill., the "feather king" of the United States, what caused the downfall of the ostrich and he said:

"The ostrich sang its own death dirge. It was always a liability and not an asset. It ate too much and was too hard to catch. While there is always some demand for ostrich feathers, it is not sufficient to pay a profit to the ostrich farmer at the present time. So, most of the birds have been destroyed, the owners keeping only enough for breeding purposes. The passing of the trimmed hat has, of course, affected all feather trades, but hat trimming is only one branch of the business—a widely diversified industry. Ducks, chickens, geese and turkeys now supply the world with an endless variety of feathers."

Naturally, because of its size, the turkey furnishes more feathers per head than does any other domestic fowl. A turkey dressed for the market yields about one pound of feathers. That does not sound like a great deal, but, considering the enormous number of turkeys needed to make a Thanksgiving or Christmas holiday in the United States alone, and the further fact that the plumage of 20,000 turkeys fills a ten-ton car, it will be seen that the turkey is a bird of plumage which is not to be discounted.

Last year one factory received 150 carloads of turkey feathers, mostly from Texas. And while it is true that this state produces more turkeys than any other, it supplies only about one-tenth of the annual "harvest," the balance being distributed more or less equally among the other states and territories. Why emphasize the Texas turkey? What of the New England turkey of historical renown?

In the early days of our colonial history, our forefathers feasted on wild turkeys when celebrating their annual Thanksgiving for a bountiful harvest. At that time, the turkey ranged wild from Canada to the Gulf of Mexico. The do-

Bales of Turkey Feathers en Route to the Factory, to Be Transformed into Ostrich and Paradise Plumes

Doomed by Their Own Appetites and General Uselessness; Part of a Herd of Ostriches, Above, and an Ostrich Being Fanned with Its Own Plumes, Right; Below, Scraping a Synthetic Plume Made from a Turkey Feather

mestic bird has now taken the place of its wild brother at the holiday feast, but it has never been so thoroughly domesticated as to cease its wandering. It loves the great open spaces. As civilization spread in the east, Mr. Turkey moved west, first to Ohio, later to Illinois, still later to Iowa. Now it thrives in Texas, where range is free and spaces are wide. When Texas becomes too thickly settled, the turkey, like its forerunner of the range, the Texas longhorn, will probably be driven across the border into Mexico, for in the realm of free ranges, Texas is the turkey's last stand in this country. In spite of its roving habits, the turkey is a tractable bird. When its owner is ready to send his stock to market, he rounds them up cattle-wise and drives them in great flocks to the nearest shipping point.

With the ostrich it is a different story. It is hard to catch. Like its first cousin, the South American rhea, which thrives on the pampas of Argentina, the African ostrich is a prize sprinter. In Africa it is hunted over the veldt by natives on fleet-footed horses. In Argentina, the rhea—smaller than its African cousin, with three toes instead of two and an undeveloped tail—is captured by gauchos (Argentine cowboys).

And after ostrich or rhea is caught, what have you? A tough carcass that

can't be served on a dinner table; a supply of eggs that no one wants for breakfast and a bundle of plumes. Even if the plumes are salable, raising birds for plumage alone is too expensive a process in these days of business efficiency, when such plumage has no utilitarian value other than popular fancy.

Times have changed since the days of old when knights as well as their ladies wore plumed headgear. Ostrich tips were then the vogue and continued so down to modern times until they reached the peak of their popularity some twenty years ago with the introduction of the willow plume. It was an American milliner who, improving on nature, conceived the idea of the willow plume—a cascade of feather plumage which sprang into instant popularity with the wearers of picture hats, and for two short seasons dominated the millinery market without rival.

A few years later the war came. Women entered business. The motor car became a household word. Bobbed hair sprang into fashion. Simple styles prevailed and the small, untrimmed hat appeared. The dealer who traded in feathers wholly as items of wearing apparel was out of luck.

But the turkey kept on gobbling. Long before the willow plume had waved its brief triumph over the world of fashion turkey plumage had been popular. Perhaps it was the memory of his grandmother's turkey-tail fan or her turkey-wing duster, that gave Frank Foster the idea of turning turkey feathers into money. It was in 1895 he branched out from his original poultry-dressing and packing plant into the business of renovating and selling the feathers which previously had been discarded as waste.

By selecting and shipping to a New York millinery jobber a collection of high-grade "downs" from Texas turkeys which he believed would make as good marabou as any grown in Africa, Foster opened up for himself a branch of the feather business which has grown by leaps and bounds.

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Part of a Flock of Texas Gobblers Which Furnish Meat for the Table and Feathers for the Hat and Other Purposes; the Lone Star State Is a Turkey-Growing Center

His first order, as a result of that experimental shipment, was for 1,000 pounds of down, which meant that 33,000 pounds of turkey feathers had to be sorted, since a ton of feathers yields only sixty pounds of down. Today, when the business is good, it is no uncommon sight to see a train of twenty-five cars, all loaded with feathers baled up like cotton, steam away from the tracks of this factory. Not all turkey feathers, of course, but duck, chicken and goose feathers as well, though the turkey feathers are the biggest part.

All these feathers are merely a by-product of birds that are raised for their food value, and killed so that the plumage is unharmed. The entire process of killing and dressing a bird for the market requires just about one minute.

The peak of the feather business is reached when the Thanksgiving and Christmas poultry is dressed for market. Then, when business is dull, the feather magnates sit around and conjure up new methods of stimulating the market. It was on one such dull day that a manufacturer conceived the idea of making a bird of paradise by taking the long wing quills of a black turkey, tearing out certain flues, or barbs, to give it an uneven appearance, softening and bending the quill to give it the grace of the true "paradise," and another made a white aigrette from the tail of a white turkey.

Human "Bullet" Emerging from the Cannon; the Man Was Shot 130 Feet and Landed Unharmed in a Net

MAN IS SHOT FROM BIG CANNON OVER HUNDRED FEET

Converting himself into a human projectile, an Italian stunt performer recently was shot from a special motor cannon invented by his brother. He landed 130 feet away in a net, none the worse for his experience. A carefully measured charge of powder was used for the experiment.

"MOVIES" PRINTED IN BOOK AS AID TO STUDENTS

The familiar device of successive, slightly different pictures, bound so that the loose edges can be flipped off the thumb, exposing the scenes so rapidly as to create the illusion of moving pictures, has been adapted by an enterprising inventor to give visual instruction to students. Instead of the usual illustrations in a text book, his plan provides for series of movies, the pictures being printed along the edge of the pages. When thumbed, they appear to have life, and the student can stop and inspect any of them.

Part of the Radio-Picture Apparatus and Samples of the Work, Showing What Large Photographs Are Reproduced; an Important Part of the Process Is Accomplished by Means of Compressed Air on Treated Paper

RADIO PHOTO BIGGER THAN LIFE ON GIANT RECEIVER

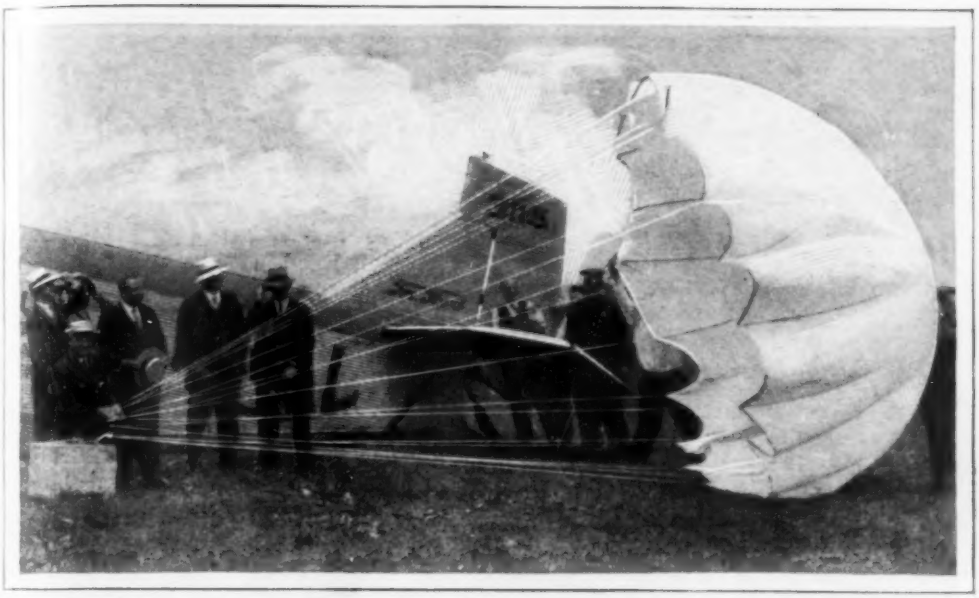
Radio pictures larger than life-size, adaptable to show window or stage presentation where many persons can see them at one time, have been recorded on a huge receiver devised by Capt. Richard H. Ranger. At a recent banquet, written messages from men in distant lands were received by radio and displayed so that all present could see them. The apparatus promises a substitute for the usual posted newspaper bulletin. Placed in an office window, it could register messages in such large form that copying news dispatches for public display would be unnecessary. The operation of the apparatus is not complicated, an essential unit being a "gun" which forces jets of air upon chemically treated paper according to incoming electric impulses to form little dots that constitute the finished picture. In this outfit, light and dark areas are produced, not by dots of different size, but by variations in spacing. The gun moves smoothly back and forth across the machine, about twelve seconds being required to make a complete trip, and, with each journey, the paper is automatically taken up about one-tenth of an inch. The transmitting equipment is essentially like that of other radio-picture machines. A beam of light passes through the film and actuates a photoelectric cell to set up electric currents proportionate to the light and dark areas on the original. These currents are amplified at a radio-sending station and made to actuate the gun on the receiving apparatus.

GIANT LIGHT RIVALS SUN

Visible at 200 miles the beam of a giant searchlight can produce the effect of sunburn at two miles and will blister the skin of a person 1,000 feet away. It is of 1,385,000,000 candlepower, much more powerful than any beacon heretofore in use. Engineers estimate that the crater of its arc is the hottest spot on earth, about 38,000 degrees Fahrenheit, and as bright as the sun at noon. One engineer declared that if the Mt Wilson observatory were on Mars, it would be possible for a person looking through it there to tell the minute and the hour the huge light was turned on.

ASH TRAY AND GEAR SHIFT COMBINED IN ONE

The perplexing problem of where to put an ash tray in an automobile has been solved by one manufacturer, who points out that his combination of the ash receiver with the ball atop the gear shift makes one piece of apparatus do the work of two. The combination ball and tray is heavily enameled in bright colors and fitted with a removable nickeled ring at the top. This has a projecting tube extending down into the hollow ball, which is so designed that, when the lever is shifted out of the vertical, the ashes are trapped behind the tube.



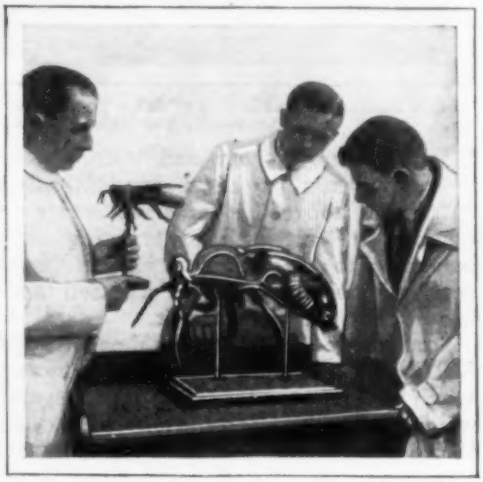
Safely Down from the Airplane; Crated Typewriter Attached to Parachute, with Which It Was Landed from Moving Ship, Showing How Deliveries Can Be Made in Transit

AIR TRUCK MAKES DELIVERIES BY PARACHUTE

Successful delivery of typewriters from midair was accomplished recently, pointing a way to still further use of the airplane as a factor in commerce. The machines were specially packed to avoid damage by jarring and were received in perfect condition, as the parachute allowed the box to settle gently to the ground. By saving a landing, the plan expedites deliveries and decreases cost.

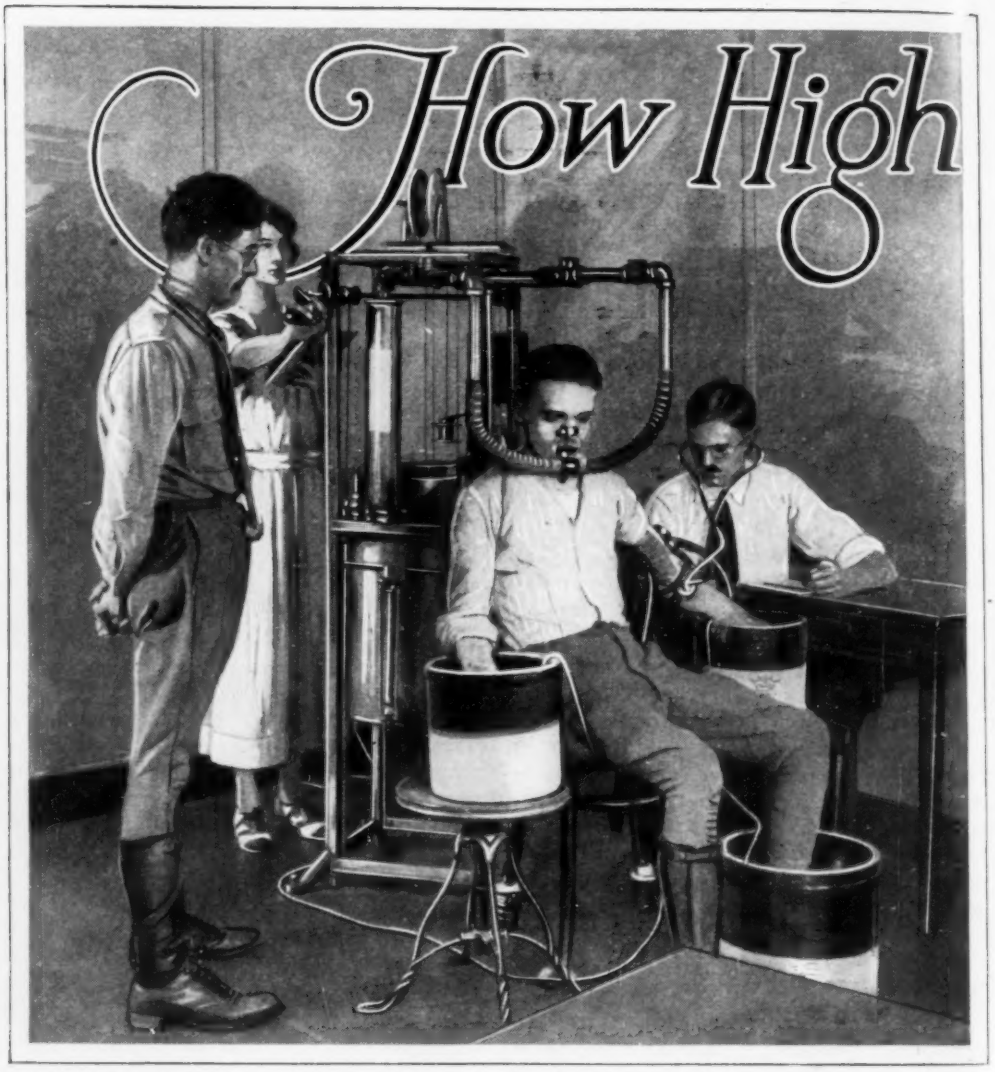
SECRETS OF BEE-RAISING TAUGHT AT NOVEL GERMAN SCHOOL

There are more tricks to successful bee culture than the average person realizes, and recognizing this fact and the importance of the business as a source of revenue without the necessity of large investment, German experts have organized a school for bee raisers at Erlangen. All phases of the work are taught in a highly scientific manner. Students are shown a huge model of a bee so that they may become familiar with its honey-gathering organs and other parts. They are also taught to recognize various diseases of the insects and how to treat them. For this purpose, a well-equipped laboratory with microscopes and other instruments is provided. For demonstration purposes, various types of hives and frames are used and outdoor lectures are part of the course. One of the most interesting units is a special gauge that shows the temperature inside the hives at all times. A feature of the school is the strict cleanliness that is observed in all the laboratories, lecture rooms and places where the honey is extracted.



Students of Bee-Raising School Examining Model

How High



With Hands and Feet in Jars of Saline Solution and a Breather Mask over the Face to Analyze the Breath, an Army Flyer Undergoes the First Step in High-Altitude Testing

THE dream of flyers and scientists for many years of some day ascending 50,000 feet above the earth will never be realized, at least with any existing form of equipment, according to the results of tests made by the school of aviation medicine of the war department.

Somewhere in the neighborhood of 45,000 feet, or slightly more than eight and a half miles, is the absolute limit, beyond which the human body, even when reinforced with oxygen-breathing apparatus, cannot go. As Capt. Hawthorne C. Gray, army balloonist, reached 42,470, or 230 feet more than eight miles, in a recent world's record-breaking balloon flight, the absolute limit has almost been reached.

The army air medicine school found the limit by the simple process of reproducing upper-air conditions in the laboratory at Washington. Subjects were placed in an air-tight tank, equipped with oxygen-breathing apparatus, and the air then pumped out until the pressure had been reduced as low as it becomes in the higher altitudes. Through glass windows the experimenters watched their subjects as they tried to perform designated tasks, and

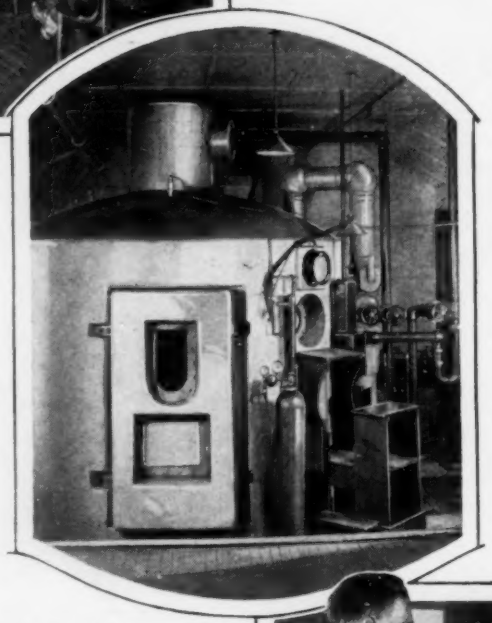
Can Man Fly?

when, by their aimless actions, they showed they had gone out of their minds and were on the verge of collapse, the pumps were reversed and air gradually restored to normal pressure.

"The life of man is dependent not on the quantity or percentage of oxygen in the atmosphere but upon its pressure," declares Dr. L. H. Bauer, former commandant of the school of medicine. "Somewhere between 40,000 and 50,000 feet is undoubtedly the absolute limit for man, even when supplied with oxygen, under ordinary circumstances. Somewhere between these limits, the exact point varying according to the temperature of the air, the barometric pressure is reduced to 100 millimeters of mercury, in other words, the air will support the weight of only that small fraction of an inch of mercury, instead of supporting about thirty-nine inches, as it does at sea level. From this atmospheric pressure must be deducted forty-seven millimeters of water vapor, which accumulates in the inspired air before it reaches the lungs. This leaves fifty-three millimeters possible available oxygen pressure if pure oxygen could be breathed. If a man was breathing absolutely pure oxygen this would be sufficient to sustain life, but under no present available method of taking oxygen, either through a tube or a mask, does the oxygen remain undiluted. It does become diluted by the nitrogen in the air. Also, under the effects of the diminishing pressure, nitrogen is given off by the blood, as in caisson disease, which attacks workers digging deep foundations. This nitrogen from the blood still further dilutes the air. If the oxygen pressure could be kept up to about fifty-three millimeters, it still would be necessary to maintain the carbon-dioxide pressure."

Testing the Field of Vision for Form and Color with the Perimeter; One of the First Eyesight Examinations for Flyers

That is the technical explanation of what the doctors find happening. How it feels to the aviator is something else. Capt. Gray, after his altitude flight, described the limit as the point where one feels as though the surrounding air wall, which is



practically missing, was needed to give the muscles operating the lungs something against which to push. To the man suffering from want of oxygen the feeling is that the lungs lack leverage to do their work and inhale the life-giving gas.

One way of defeating the high altitude would be to inclose the flyer in an air-tight cabinet or cabin in which ground pressure could be maintained, no matter to what level he goes. That may come in time, but to date the only experiment in which it was tried nearly ended in disaster.

An airplane with an air-tight cabin was built at McCook field, the army experimental laboratory at Dayton, for Lieut. John A. MacReady to use in one of his attempts to break the altitude record in a heavier-than-air machine. To insure against leakage of the air, the manhole through which MacReady entered the plane was equipped with a door that screwed on from the inside, so that the pressure within the ship would hold it tight and seal the joint. The lesser the pressure outside, it was reasoned, the more pressure against the door and hence the better the joint.

The theory proved out almost too well, for, while flying at an immense height, MacReady's oxygen apparatus went bad. He began to descend, and, as the air within his cabin grew more and more stale, he struggled to remove the door and admit fresh air from outside. But the pressure against the manhole cover was so great that even after the bolts were removed it stuck in its place and all his efforts could not dislodge it. MacReady was almost unconscious before he reached a low enough level to balance the inside and outside pressures and free the door.

A somewhat similar air-tight balloon basket was built at McCook field and sent to Capt. Gray for trial, but the balloonist refused to risk it. He pointed out that, when ascending or descending slowly, an aeronaut's body could adjust itself to enormous changes in air pressure, but that a flyer imprisoned in an air-tight cabinet

Two Other Visual Tests for Flyer Candidates, Depth-Perception and Eye-Convergence Measurements; Center, the Low-Pressure Chamber

Rebreather Apparatus Which Measures the Chemical Change of the Breath, and a Rotation Test

would be lost if anything should go wrong at an immense height and make it necessary for him to take to his parachute. Under such circumstances it would be fatal to open the door and try to escape, for the sudden transition from ground pressure to a semi-vacuum would be more than blood vessels could stand and they would probably burst.

Another method suggested is to equip the flyer with a suit somewhat like that worn by divers, but so constructed that the high pressure inside would not expand and tear it. With a pneumatic suit it might be possible for the wearer to move freely and even leave his ship by parachute, if necessary, provided the chute was built big enough to carry the added weight. Such a suit, or even an air-tight cabinet, would have to be provided with some means of absorbing the excess carbon dioxide, for, while a small amount is necessary, too much is dangerous.

The tests in the army pressure chambers in Washington and at flying fields in various parts of the country have shown that the effects of altitude on a flyer usually steal on him unaware. The most striking effect is on the nervous system and takes the form first of stimulation and a feeling of well-being. This is followed immediately by a decrease in the field of attention, in which the aviator is easily distracted from his work, loses control of voluntary muscles and finds it increasingly

hard to concentrate on his tasks. His muscles fail to obey the brain messages, and he may reach in one direction for a control, as he believes, and actually be reaching in an entirely different quarter. Yet he is not conscious of doing a thing wrong. As the tests continue and higher altitudes are simulated, the flyers suffer from loss of memory, judgment and hearing and even their vision is impaired just before unconsciousness comes.

The experiments show that the oxygen apparatus should be turned on when a flyer gets not higher than 20,000 feet, and that between 23,000 and 25,000 is the absolute limit to which even the best of men can go and retain consciousness without using oxygen.

CHILDREN BUILD TROLLEY CAR AS KINDERGARTEN LESSON

After a visit to the electric-car barns, children of a San Francisco kindergarten constructed a realistic replica of a trolley car to show how many details they had absorbed on their sight-seeing tour. Bell cord, controller and fare boxes, straps and other common features were represented, even to advertising posters. Two of the children donned blue paper caps of their own make, labeled "motorman" and "conductor," for a "trip" to a reproduction of a park nook the class had made.

HOW WORLD LOOKS TO A DOG; EYES OF LITTLE USE

The world looks entirely different to a dog than it does to a man, according to Dr. Donald A. Laird, of Colgate university. Tests have proved that a dog sees black and white, but is color-blind. The American flag is seen by the animal as white and gray stripes, for it has been disclosed that his eyes are very deficient in discriminating patterns. A small flag looks to him like a solid, light gray. While a dog can see no more details than a man can through a telescope that is badly out of focus, his eyes are especially keen in sensing motion. Chickens and monkeys have much better pictures of the world, being able to see patterns more clearly,

Toy Street Car Constructed by San Francisco Kindergarten Children after a Visit to the Trolley Barns; the Class Took an Imaginary Journey to a Model Park They Had Made in the Room

and also to see many colors. Almost all animals are unable to see colors, except monkeys, birds, and possibly some fishes. The dog shares his handicap of color-blindness with the bull, for instance. Many people believe that the bull is angered by the sight of red, when, as a matter of fact, the bull cannot tell red from gray. While the dog is blind to all colors, most birds can see all colors except blue and violet, and although fish have color vision, many of them are apparently afraid of red. In a heavy twilight, men are totally color-blind, and also unable to distinguish patterns. It is then that we probably see the world the most like it looks to a dog. As a compensation, the sense of smell is keener in many animals than in man, and especially in dogs.

At One End of the Big Nozzle That Throws 3,000 Gallons of Water a Minute; View on Los Angeles Fireboat

SAFETY GLASSES FOR SPORTS GUARD WEARERS' EYES

Persons who must wear glasses are guarded from injuries to the eyes while engaged in sports by a double-rimmed spectacle frame. The lens is in the rim nearer the eyes, the outer one shielding it from breakage. The frame is made of a strong nickel alloy and a metal strap above the nose affords additional security.

¶Write our Bureau of Information if you wish to know who makes or sells any article described in this magazine. Send no postage; the service is free.

FIREBOAT WATER GUN THROWS FIFTY GALLONS A SECOND

Los Angeles claims one of the most efficient fireboats in the world in a ninety-nine-foot vessel propelled with gasoline motors. It is equipped with twenty-nine nozzles that have a combined capacity of 12,000 gallons of water a minute, one of them throwing 3,000 gallons in that time.

CARBON ESSENTIAL TO LIFE

While carbon makes up less than one per cent of matter, it is the characteristic element of living material and is increasingly important in industry, being the basic element of all combustibles. A boy who weighs seventy pounds has in him about forty-four pounds of oxygen, twelve of carbon and six of hydrogen. Carbon forms part of all foodstuffs, and has the remarkable characteristic of uniting with almost all the solids and gases. It is derived from the air, from carbonic acid, and, absorbed by plants, goes to the building up of living matter and of foodstuffs.

PLANE REPLACES DOGSLEDS FOR ROYAL MOUNTED

© P. & A.

"Queen of the Yukon," Sistership of the "Spirit of St. Louis," Lindbergh's Famous Plane, Now on Regular Schedule for Royal Canadian Mounted Police Duty between White Horse and Dawson

The Royal Canadian Mounted Police, famous peace preservers and man hunters of the Arctic regions of the New World, have taken to the air. Their new monoplane, "Queen of the Yukon," sistership to that in which Charles Lindbergh flew the Atlantic, is now on regular schedule between White Horse and Dawson, piloted by a veteran of the air force. The plane takes the place of twelve dog teams and sledges, which have been carrying mail, express and passengers. These dogsleds have been the only means of communication over the 360 miles between the two points, requiring thirteen to fourteen days to make the trip, while the plane makes it in four and one-half to five hours. Regular schedule will be maintained by the new "Queen of the Yukon" and mail and a limited quantity of express will be carried on each trip. It will be at the command of the police at any time, to pursue outlaws, either along its regular route or over any part of the British domain in the Pacific northwest.

TEST CHAMBER SHOWS IF MEN CAN STAND TROPIC LIFE

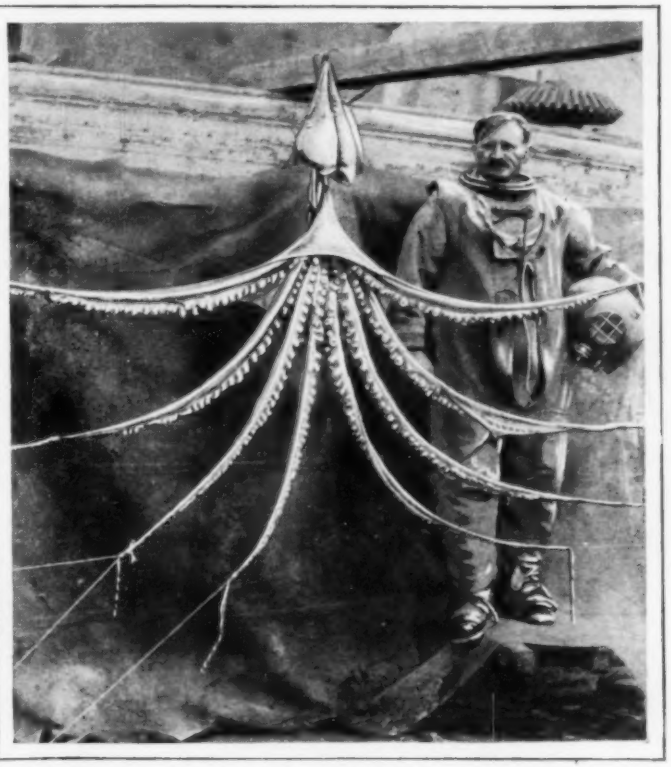
To determine if candidates for positions in its colonial possessions can withstand tropical climate, two scientists have constructed for the French government a testing chamber in which subjects are placed and, for two days or more, are exposed to conditions closely duplicating those of the torrid regions. The room is lined with cork to maintain an even temperature, the chamber itself is of metal incased in wood, two inches thick, and there is a double door of glass. A bed, a chair and a bicycle are the chief articles of furniture. The subject rides on the latter at times, this form of exercise having

been demonstrated as establishing a basis for the measurement of muscular energy. Reactions of the body are measured, and evaporations in the room are drawn off and tested. Food is conveyed through a special aperture in the walls, so arranged that the air within is not disturbed. While the chamber has been constructed especially for testing prospective colonial workers, it is adapted to similar examinations for men in various other industries.

GIRL TRAINS BIRDS FOR MOVIES

"Teach them while they are young," is the motto of Caroline Conger, twelve years old, who raises and trains birds to perform in the movies. At her "school" near Hollywood, she has ladders and other apparatus for the birds to learn to climb, and begins instruction almost as soon as her pets can leave the nest.

Caroline Conger and a Few of Her Young Bird Pets Which She Trains for Movies; Teaching Starts Before They Can Fly



Capt. Eliasen and Huge Octopus He Killed after an Encounter While at Work in Sunken Vessel; He Escaped from Six Others

DIVER SLAYS HUGE OCTOPUS IN SUBMARINE BATTLE

Incidents in fiction were duplicated in reality recently, when Capt. Ole Eliasen, of Newport Beach, Calif., killed a large octopus he encountered while at work in the submerged hulk of an old vessel. He was armed only with a knife, but managed to slash the tentacles that encircled him and behead the octopus. He escaped from a larger one and five small ones.

PLAN LONG STAY IN THE ARCTIC TO AID NAVIGATION

To establish observation posts along the south shore of the Hudson strait and make aerial surveys for weather data, an expedition has sailed from Halifax for a proposed stay of fifteen months in the Arctic. Information gathered will be used in planning for maritime commerce in the strait following the completion of the Hudson bay railway.

Diamond Drills Reveal

Tremendous Pressure of Oil and Gas Gushers Is One of the Problems of the Earth's Interior

By J. EARLE MILLER

PEOPLE who are inclined to declare that now, with the poles conquered, the Atlantic and half the Pacific bridged by air, all but the world's highest mountain scaled, and infinite space bridged by giant telescopes, man has no worlds left to conquer, are overlooking one great, and almost untapped, field of exploration.

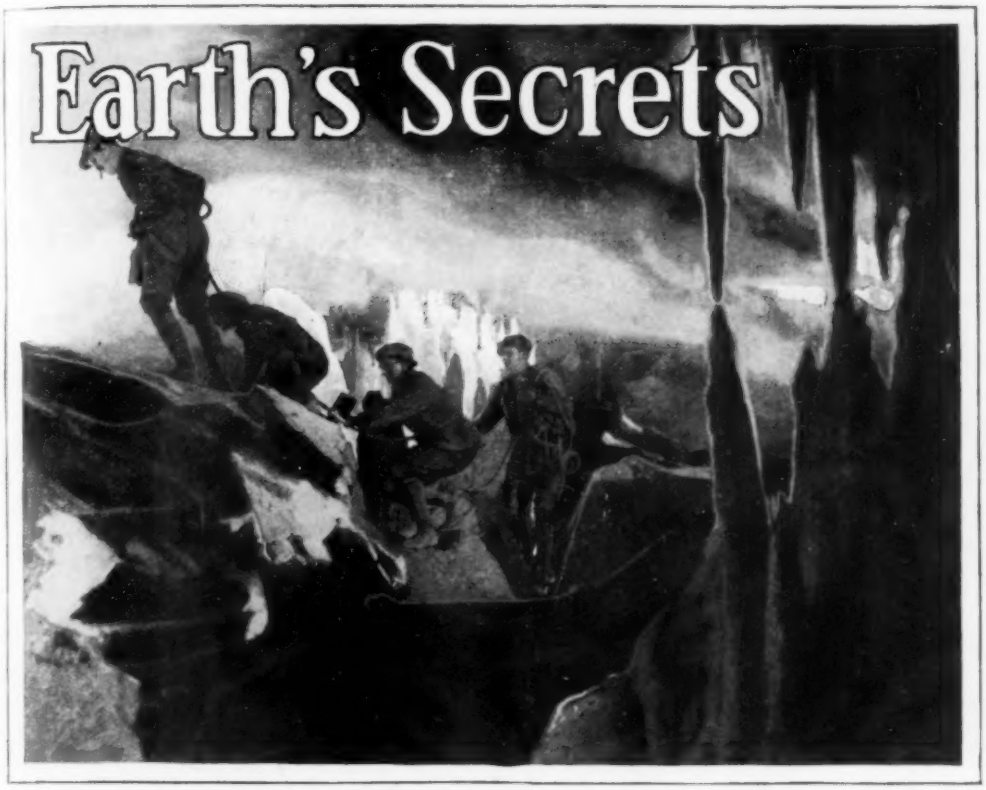
For we don't know yet what the inside of our own earth is like!

The failure to probe the interior of the earth, whose center is only a matter of 4,000 miles or so away, is the more strange when compared with the achievements of astronomy in solving the composition, temperature and living conditions, or rather lack of them, on stars billions of miles away.

While the air, the most unstable of all the elements, has been conquered and man has been up more than eight miles above the earth, the farthest he has been into it is only a mile or so, in a few exceptionally deep mines. And the farthest his proving tools have penetrated is less than 10,000 feet, or considerably under two miles, in the world's deepest oil well, now being drilled in California.

As long ago as 1904, and again in 1919, Sir Charles Parsons, inventor of the steam turbine which bears his name, proposed that a great hole be bored ten or twelve miles into the earth, not only to find what the underlying rock and mineral strata were like, but to tap and utilize the internal heat of the world as a new source of power. While inventors have been trying for ages to tap two of the world's three great undeveloped sources of energy—the rise and fall of the tides due to the attraction of the moon and the heat received from the sun—it is only in recent years that steps have been taken to put the internal heat of the earth to work. In California and in Italy steam emerging from underground jets, where water is being heated and vaporized, has been harnessed to boilers and heating plants. Similar experiments are being carried on in other parts of the world blessed with natural steam jets, but it is unfortunately the fact that these limited cases of physical phenomena are few and far between and usually far from the scene where power is needed.

Sir Charles Parsons' suggestion, however, is applicable at any place in the world where power is needed. E. W. Rice, Jr., honorary chairman of the board



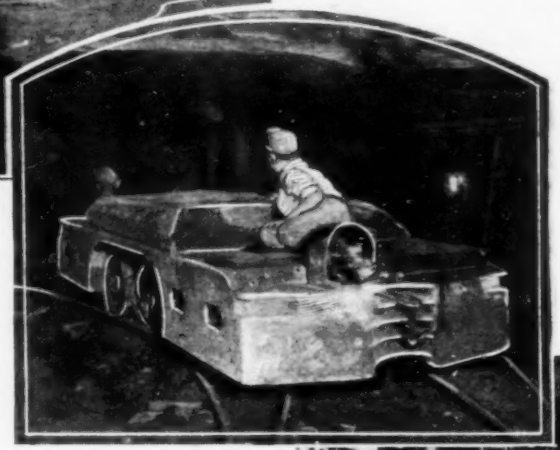
The Marvels of Such Vast Underground Caverns as the Mammoth Cave in Kentucky Have Been But Partly Explored, Giving Some Light on the Secrets Hidden within the Earth

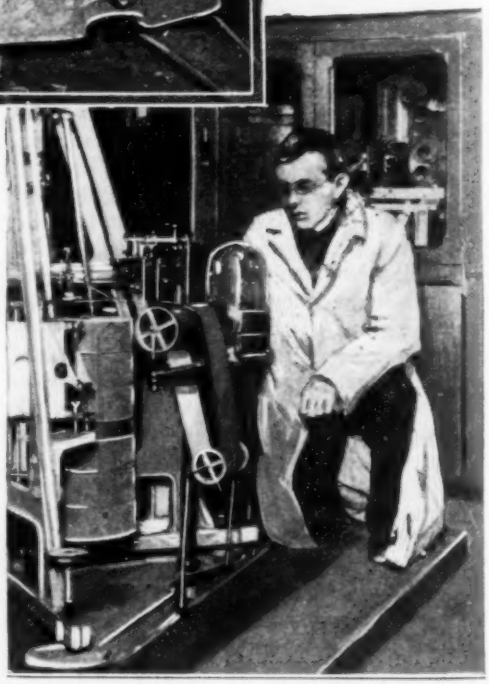
of the General Electric company, speaking before the World Power conference in London, in 1924, urged that the leading nations of the world combine to finance the sinking of an experimental shaft.

"I heartily agree with Sir Charles," he said, "in his statement that the cost of such an experiment is trivial compared with the value of the possible information which may be gained by the investigation into this unexplored region of the earth. The cost would be much less than the cost of a single battleship. If only the people and their representatives had the faith and the vision of science, the value of such an idea would have been put to practical use long ago. It is a big idea, worthy of a nation's enthusiastic support; in fact, it is worth undertaking as an international scientific enterprise, a suitable subject for co-operative work between friendly nations."

Aside from the possible unlimited power which might be developed, the tube idea holds forth other fascinating possibilities. It might uncover new and hitherto unknown minerals; it might shed new light on the problem of earthquakes; it might clear up some of the remaining mysteries of volcanic action; it might reveal hitherto unsuspected deep-lying deposits of oil; it might help solve the mystery of how oil is made within the earth; it might fix the thickness of the earth's outer and solid shell and show how it shifts and moves over the more fluid layer beneath, causing the gradual rise and fall of islands and mountain ranges, and their movement.

The ancient idea that the earth's center was a molten, flaming mass, has been discarded long ago, and scientists are fairly well agreed that it is a solid, in fact more solid than the outer shell, for during the ages, as the surface has heaved and twisted in the spasms of getting settled, the heavier material, iron and other minerals in the main, has settled to the center, and forced the lighter rocks to the surface.





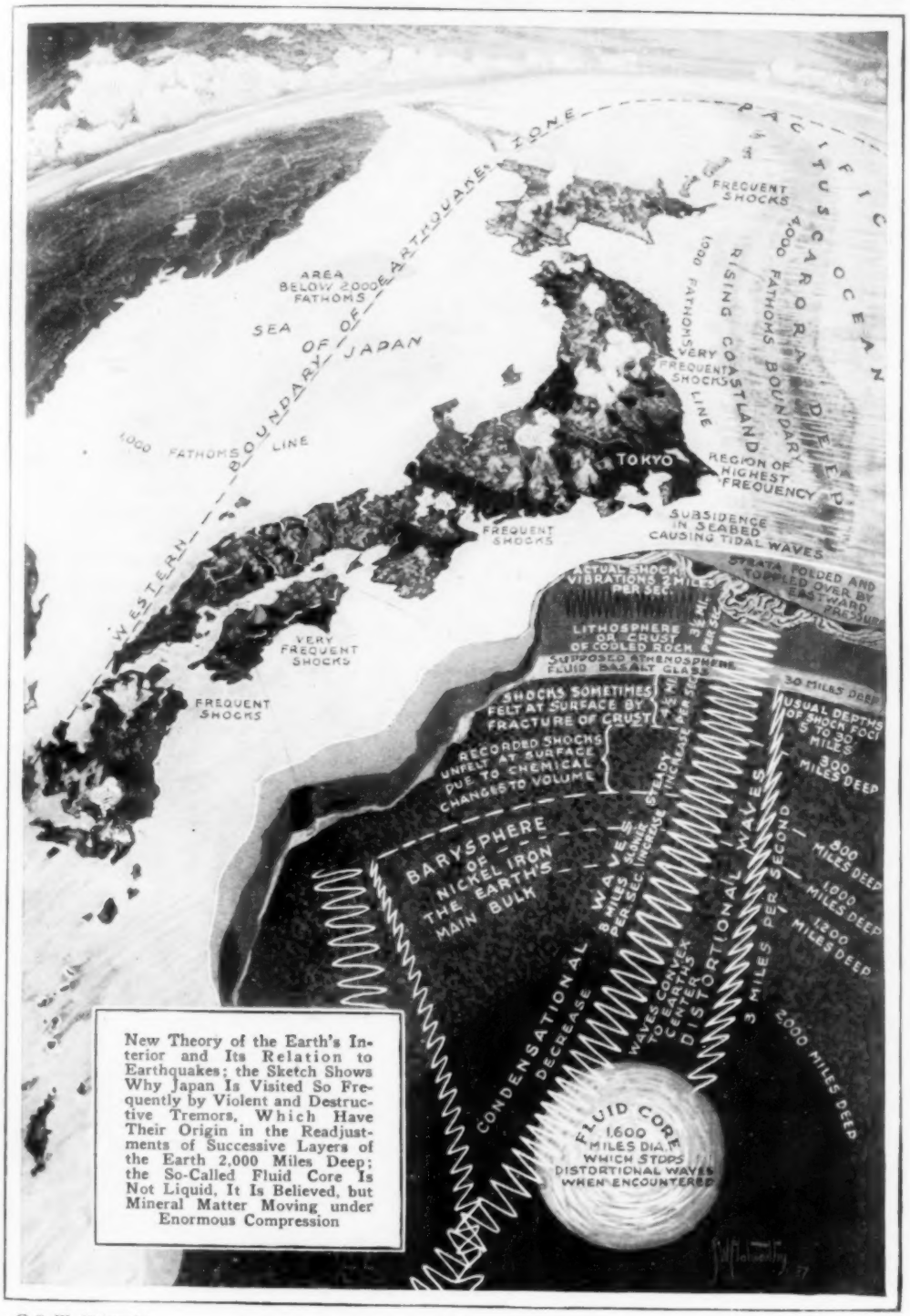
A Javanese Volcano, a Coal-Mine Work Train, and Father Tondorf in His Earthquake Laboratory at Georgetown University

In the process of settling, the lightest of the material has been raised the highest, as was proved when it was discovered that mountain masses had a lower specific gravity than the rock of the plains. Iron, nickel and similar materials are the principal ingredients of the meteors that are occasionally found on the surface of the earth after falling from the skies, and these heavy metals are prominent, in molten or gaseous form, in the stars, so it is safe to assume, scientists believe, that they may compose a fairly large portion of the earth's interior, and in a much purer form than they are found on the surface. Because of their greater weight, the metals, when found in surface deposits, are scattered through a mixture of lighter material, from which they must be separated.

The mystery of mineral oil, from which comes our gasoline, is still unsolved, though the product has been known for centuries. The school that believes oil to be an inorganic compound, the result of chemical changes taking place within the earth, is overbalanced by the more general belief that it is an organic product, probably due to the decomposition of such organic material as fishes, seaweeds and even the trees and vegetation of past ages, wiped out and buried deep by the advancing debris of the several long-past glacial epochs.

The idea that our motor cars and airplanes are being propelled by the fish which sported in the waters that covered the United States millions of years ago, long before the day of the mammoth and the saber-tooth tiger and the great cave bear, is not as odd as it may seem, for another of our most useful commodities comes from that same era and from a relative of the fishes. That is our building limestone. Place a piece of it under a microscope and it is revealed as the preserved shells of myriads of tiny shellfish.

SCIENCE EXPLAINS JAPAN'S RECENT EARTHQUAKES

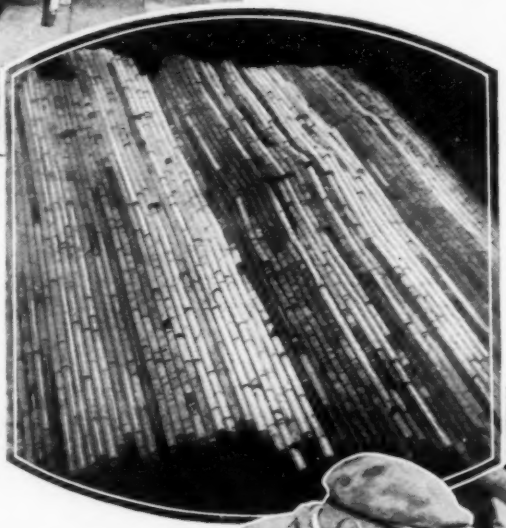

PACIFIC OCEAN
ZONE OF EARTHQUAKES
FREQUENT SHOCKS
AREA BELOW 2000 FATHOMS
SEA OF JAPAN
BOUNDARY
1000 FATHOMS LINE
WESTERN
VERY FREQUENT SHOCKS
FREQUENT SHOCKS
FREQUENT SHOCKS
1000 FATHOMS
4000 FATHOMS
ABYSSAL DEEP
BOUNDARY
RISING COASTLAND
VERY FREQUENT SHOCKS LINE
TOKYO
REGION OF HIGHEST FREQUENCY
SUBSIDENCE IN SEABED CAUSING TIDAL WAVES
STRATA FOLDED AND TOPPLED OVER BY EASTWARD PRESSURE
ACTUAL SHOCK VIBRATIONS 2 MILES PER SEC
LITHOSPHERE OR CRUST OF COOLED ROCK
3 MILES PER SEC
SUPPOSED ATHENOSPHERE FLUID BASALT GLASS
SHOCKS SOMETIMES FELT AT SURFACE BY FRACTURE OF CRUST
RECORDED SHOCKS UNFELT AT SURFACE DUE TO CHEMICAL CHANGES TO VOLUME
STEADY INCREASE PER MILE
30 MILES DEEP
USUAL DEPTHS OF SHOCK FOCI 5 TO 30 MILES
300 MILES DEEP
BARYSPHERE OF NICKEL IRON THE EARTH'S MAIN BULK
WAVES INCREASE IN SPEED
MILES PER SEC
600 MILES DEEP
1,000 MILES DEEP
1200 MILES DEEP
2000 MILES DEEP
3 MILES PER SECOND
DISTORTIONAL WAVES
WAVES CONVEX TO EARTH'S CENTER
CONDENSATIONAL DECREASE
FLUID CORE 1,600 MILES DIA WHICH STOPS DISTORTIONAL WAVES WHEN ENCOUNTERED

New Theory of the Earth's Interior and Its Relation to Earthquakes; the Sketch Shows Why Japan Is Visited So Frequently by Violent and Destructive Tremors, Which Have Their Origin in the Readjustments of Successive Layers of the Earth 2,000 Miles Deep; the So-Called Fluid Core Is Not Liquid, It Is Believed, but Mineral Matter Moving under Enormous Compression

© S. W. Clatworthy

drill is rotated by an engine on the surface, cutting out a cylindrical core, which is then hoisted for examination.

Prof. Rudolph Leschot, a French civil engineer, invented the drill as a result of his observations of the hardness of diamonds. As generally used to explore for new oil and mineral fields, it consists of hollow rods or tubes, screwed together in five or ten-foot sections, lowered, as the cutting progresses, by mechanical or hydraulic pressure. At intervals, ranging from five to thirty feet of drilling, the string of tubes is hoisted out of the hole and the core removed and examined. All the cores, from the surface down, are assembled in rows, so that the entire collection gives a true picture of every stratum from the surface to the bottom of the drill hole. For ordinary prospecting work in hard mineral formations, cores of an



Our coal deposits, too, date from ages ago when the central United States was a great tropical jungle. The jungle disappeared under the last of the glacial waves, and the trees and ferns slowly turned to carbon, just as peat beds much nearer the surface are doing today. To sink an experimental shaft into the earth to a depth of ten or twelve miles is not so difficult of accomplishment as might be imagined. It would not be necessary to make a mine shaft of it, or to send men down into the earth to get a first-hand picture of what that interior is like. The diamond drill has solved all that, and made it a simple matter to remain on the surface and get an accurate sample of every inch of depth to which the drill is sunk. The diamond drill is a hollow rod, fitted at its end with a ring of tiny diamond fragments—the hardest substance known to man. As it is sunk into the earth, the

Diamond Drillers at Work, Top; Center, Drill Cores Laid Out in Order to Show Nature of Strata in a Field, and, Bottom, the Drilling Bit of the World's Deepest Oil Well

The Willamette Meteorite, Found in Oregon, Weighs 31,107 Pounds and Is Ninety-One Per Cent Iron, Eight Per Cent Nickel, and One Per Cent Mixed Cobalt, Sulphur and Phosphorus

inch or an inch and a half are usually extracted, while in softer material, such as coal, salt or similar substances, it is customary to use a two-inch outfit. Drills of much larger size can be made, however, so a six or eight-inch shaft might be sunk. The small sizes are used merely because large supplies are not needed, and would not justify the additional cost of diamonds for a bigger bit. From two to fifty diamonds are commonly used in a bit, depending on the hardness of the material to be encountered.

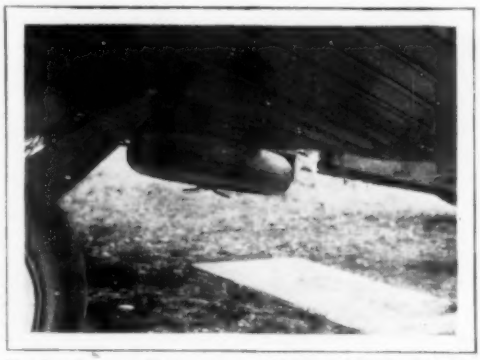
The only problem to be solved in building a drilling outfit for a ten or twelve-mile tube is the handling and turning of the enormous weight of drill shaft and drill. It might, however, be possible to solve it by building a drill and core tube of fairly short length, driven by an attached electric motor, the whole supported by a single cable.

Modern drills do not use white-diamond chips, but instead employ the black diamonds, or "carbonados," which are found in the state of Bahia, Brazil.

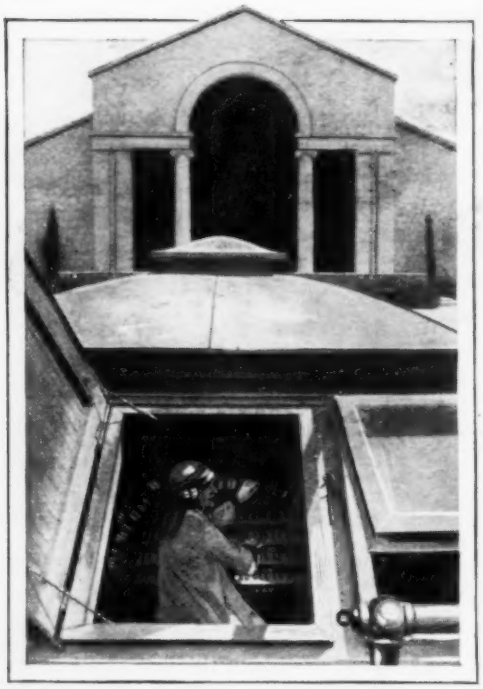
Exploring the interior of the earth may not be so spectacular as jumping across the oceans by plane or flying over the poles, but if the Parsons shaft is ever sunk, it may have a more far-reaching effect on daily life than any single exploit in history.

SPARE TIRE FOR ARMY PLANE AIDS SAFER FLYING

Some of the new army planes at a western flying field have been equipped with a spare tire for the landing gear. It is carried underneath the control pit, where it is ready for service in case of an emergency. Forced landings on rough ground frequently result in damage to the tires, and the spare simplifies the task of fitting the plane for another take-off if the tires should be punctured.



Ready for an Emergency; Airplane Equipped with Spare Tire for Its Landing Gear



Outdoor-Organ Console Placed Some Distance from the Pipes, to Prevent Injurious Effects of Vibrations

PIPE ORGAN PLACED OUTDOORS FOR CONCERTS IN PARK

Visitors at a park near Los Angeles may enjoy pipe-organ music in the open, a huge instrument having been erected near the center of the grounds. Because of the strong vibrations, from the bass pipes particularly, it was necessary to place the console more than 100 feet away and shield it in glass to protect the keys from the jar and also to shelter the organist.

FIND LIPSTICKS CENTURIES OLD IN AUSTRIAN RUINS

That the lipstick is not a modern innovation is shown by interesting finds in lower Austria, where relics of the prestone age have been unearthed. Among the ruins were sticks of graphite, probably used as eyebrow pencils, lumps of ocher and receptacles containing rouge powder. This collection of cosmetics is possibly 25,000 years old and was found with the carved figure of a woman made from a mammoth's tusk, and bones of an ice fox, probably placed to propitiate the gods of the chase, for it is known that man of this era always buried the bones and hides of various animals he desired to kill as an offering to the gods. The graphite stick had smooth, worn surfaces where it was applied to the face with reindeer fat, to make it adhere to the skin.

NEW ANAESTHETIC IS INJECTED TO AVOID LUNG TROUBLES

Berlin physicians are reported to have developed an anæsthetic especially suited to patients who have lung disorders that make it unwise or impossible to administer narcotics by inhaling. The new substance is a liquid which is injected into the system and is effective when total or local anæsthesia is desired. Alcohol and bromine are mixed in the preparation.

CLEAR VIEW IN ANY WEATHER GIVEN BY ANTI-FROSTER

An effective means to prevent the accumulation of frost or moisture on the automobile windshield has been found in a circular sheet of transparent material held to the glass by vacuum cups. To overcome frost or steaming it is attached on the inside, but to the outside when driving in a snowstorm. An additional feature is an amber-colored glare shield which can be adjusted to meet requirements. The preventer may be cleaned by washing it in lukewarm water and rinsing in cold.

Circular Disk in Place on Windshield, Showing How It Clears a Wider Space for the Driver's Vision

REPTILES SERVE THE ULTRA WHIMS OF FASHION

How Long Will the Snake-Skin Fad in Fashions Last? Typical Uses of the Material Which Is Applicable to Many Purposes; the Markings Have Been Widely Duplicated in Fabrics

The vogue of fancy leathers for shoes and trimmings has created a demand for the skins of snakes, lizards and crocodiles. Complete costumes even are being made from the coverings of reptiles. When tanned, the skins of certain species from tropical countries reveal an infinite variety of color and design. English and Dutch merchants were the first to place on the market articles made from the water snake of Java, Borneo and Sumatra, while the Parisian specialists of today obtain pythons from equatorial and occidental Africa and Madagascar, pelophiles, with brown or black spots, from Guiana and the terrible boa constrictor and the Eunecte, with grayish scales mottled with red, from the Antilles. But the fabrication of handbags, portfolios, belts or small trunks, from the skins necessitates most delicate operations. The tanning of reptile skins is accomplished by means of certain mixtures, the secret of which is jealously guarded by each manufacturer. When tanned, the skins of reptiles pass to the hands of the leather workers who make the articles. The worker cuts the skins after models which have been given to him, his implements being plaques of zinc and a shoemakers' knife.

BEAUTY OF OLD STONE BRIDGES LOST IN NEW ONES OF STEEL

Landmark of the Type That Is Fast Disappearing in Belgium; Old Arch Bridge of Times before the War

While restoration of war-torn areas in Belgium and other countries has left many features better than they were before the conflict, the substitution of steel for stone in rebuilding some of the old bridges has been deplored because much of the beauty of the ancient structures is lost. The reason for the change of material is largely due to the scarcity of skilled labor since the war. There are fewer masons who know how to build the stanch stone arches, hence the employment of steel has been necessary in many cases. Although more serviceable than the stone viaducts, the new ones do not harmonize so completely with their environment.

FIVE MILES A MINUTE ON RAILS OBJECT OF NEW LINE

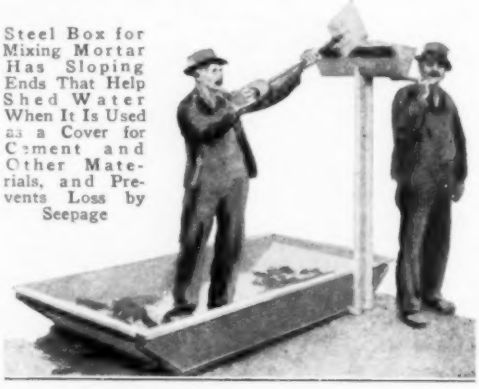
Railroad speed of from 200 to 300 miles an hour will be common if a test line being built by an English engineer is successful. He plans to eliminate trains, substituting a single car containing the propelling unit, which will be operated by electricity or gasoline and streamlined to decrease air resistance to the utmost limit. Each car will carry from sixty to 350 persons, and there is a special arrangement replacing the usual flange tire to prevent derailment. Grade crossings would be eliminated to insure fast schedules with safety and it is expected that the car will be able to climb steep grades with ease, as a special design of outer tires of high frictional capacity has been provided.

GRASS TO GUARD SEA WALL HELPS RECLAIM LAND

To protect the sea walls along the coast of Essex, England, rice grass, a rushlike growth that appeared in that section of the country about sixty years ago, is being planted. It has the peculiar property of collecting mud, thus raising the level of the shore inch by inch, so that acres can be reclaimed for pasture and other purposes. The cost of maintaining the sea wall is also reduced. Success of the method has led to exportation of hundreds of the plants to other countries.

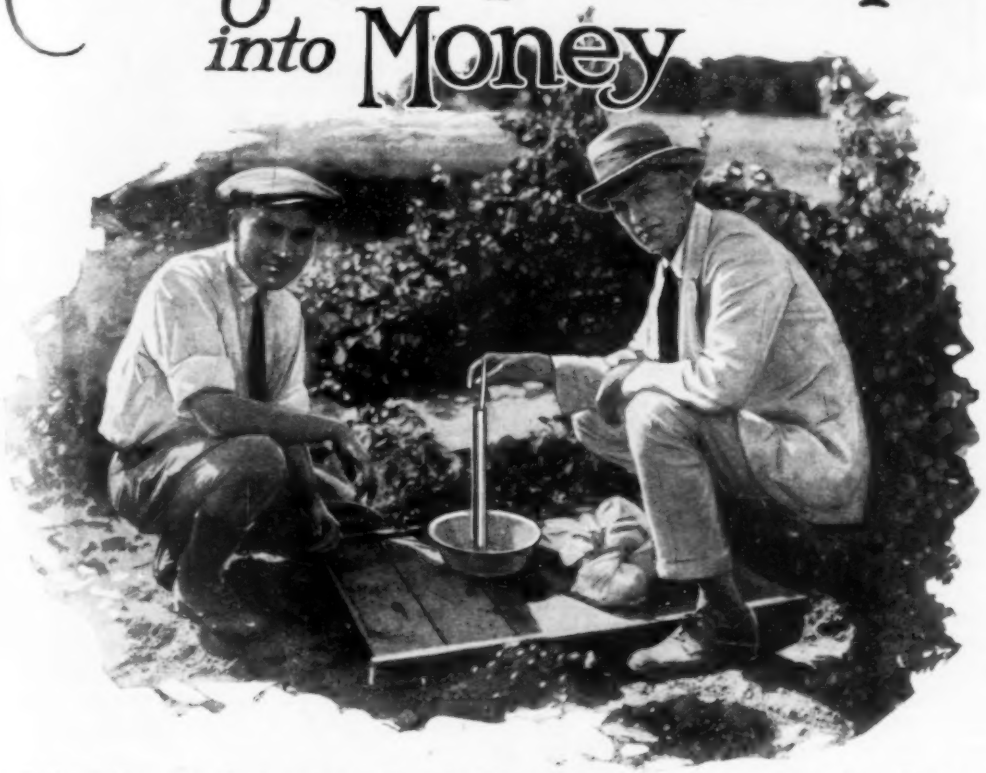
STEEL MIXER BOX FOR BUILDERS SERVES AS CEMENT COVER

Said to outlast a dozen wooden boxes, a welded-steel mixing vat for preparing cement, plaster and other building materials, prevents loss through seepage, fires can be built under it in winter time to keep batches from freezing, and, by turning it over when empty, it forms a convenient cover for a pile of cement or other supplies. It is easy to clean and facilitates mixing because of its smooth, level bottom.



Steel Box for Mixing Mortar Has Sloping Ends That Help Shed Water When It Is Used as a Cover for Cement and Other Materials, and Prevents Loss by Seepage

Coining Surplus Crops into Money



Testing Raisins with a Saccharometer, to Determine Whether They Have Gained the Proper Sugar Content for Picking; the Instrument Eliminates All Guesswork in the Vineyards

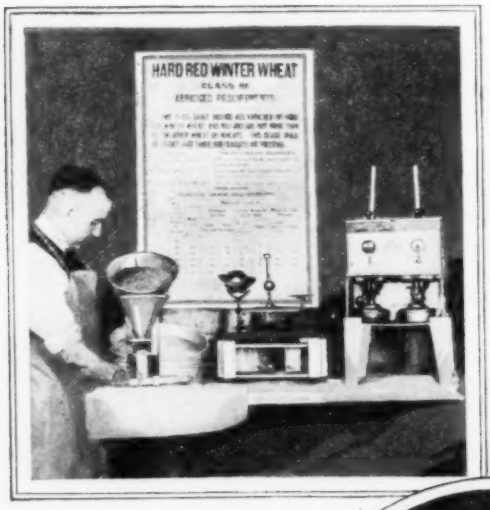
By C. MORAN

FARMERS are solving their surplus problems by developing new uses for their crops, ranging from the manufacture of apple sauce to xylan, which is a base for sulphur dyes.

California fruit growers are using surplus oranges and lemons in manufacturing fruit juices, oils, pectin, marmalade, and the like. Consolidated raisin growers are building a factory for the manufacture of raisin sirup and a feed for dairy cows. Surplus cranberries are being made into sauce and apples into apple sauce. The walnut growers are making high-grade charcoal from shells.

Potatoes also are being made into starch; wheat straw into gas; rice hulls into cellulose which is used in the manufacture of hundreds of commodities, from imitation leather to artificial silk: peanut shells into dynamite fillers and cattle feed. More than 150 uses for shelled corn, cornstalks, leaves and cobs are listed, ranging from acetic acid to wax. The list includes axle grease, car wheels, cob sidewalks, doormats, fiber, floor rugs, incense, laundry soap, linoleum, phonograph records, punk, sofa pillows, and radio equipment. No need for a corn surplus, say the chemists, when there are so many products into which corn can be converted profitably and cheaply.

It is estimated that from 15,000,000 to 20,000,000 tons of corncobs are wasted annually on American farms. Yet laboratory work has developed cheap processes for extracting from the cob a synthetic resin from which telephone receivers,



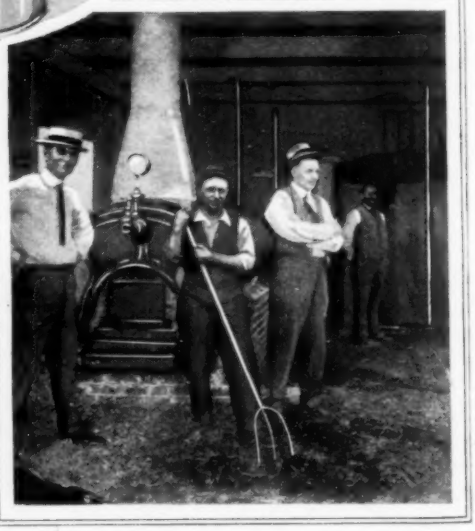
phonograph records, and noiseless gears can be made; furfural which has many uses in industry, including a base for varnish and mucilage; xylan, a valuable base for sulphur dyes; cellulose from which artificial silk is made, and which is used also in waterproofing, paper sizing and in cement.

All these materials are obtained from substances less plentiful and less efficient than corncobs. The use of them in the manufacture of a lumber substitute, where high tensile strength is not required, also has been developed recently. The substitute withstands wear and tear as well as any hardwood and will tolerate a pressure of 10,000 pounds to the square inch.

Uses for seed-flax straw include rugs, carpets, fiberboards, insulating material, upholstery, tow and thatched roofs. Flaxseed already is being used in medicines, varnish, linoleum, patent leather, artists' oil, explosives, and many other industrial products. Why a wheat surplus, the chemists ask, when the production of flax is insufficient for domestic needs, and there are more than fifty different uses for the seed and the seed-flax straw?

Up to the present time peanut hulls have been used for polishing tin plate, as a dynamite filler, a fertilizer filler and, mixed with molasses, as a cattle food. The development of new processes for utilizing California citrus fruits has been the outcome of more than ten years of chemical research. Thousands of tons of cull fruits were being wasted annually, and production was increasing. The saturation point in consumption was at hand, and it was a question of developing new uses for the fruit or of curtailing production. The result has been the establishment of new industries in California the last two years, which are doing an aggregate business of $1,000,000 a year.

One concern in Los Angeles uses sixty tons of citrus fruit a day in making juice. As citrus oils are worth approximately $2.50 a pound, the extraction and utilization of the oil means an additional return of $12.50 for each ton of cull fruit. Formerly it cost the producers $1 a ton to have the waste fruit hauled away. Another plant manu-



Top, Wheat Grading; Center, Device for Measuring the Liquid Content in Canned Foods, and, Bottom, Furnace in Which Wheat Straw Is Converted into Gas

Class in a Government School Receiving a Lesson in How to Grade and Analyze Grain; Government Inspectors Play an Important Part in the Marketing of Crops

factured 50,000 pounds of orange oil having an estimated wholesale value of approximately $100,000.

The disposal of orange pulp from which the juice had been extracted was once a distinct problem, costing about $800 a month. A method was found for the preparation and disposal of orange pulp as feed for dairy cows, and now the profits from this source amount to from $2,500 to $3,000 a month.

Similar work is being undertaken by the growers of pomegranates in the manufacture of sirups and concentrates for use at soda fountains. A satisfactory concentrated juice and jelly have been extracted experimentally, and commercial processes are being developed. Experiments with pineapples are yielding methods of extracting juice from the hitherto wasted skins and cores.

The demands of the market for more carefully graded fruits and vegetables result each year in larger quantities of culls remaining at the producing centers. One of the pressing problems of fruit and vegetable growers is to find more profitable outlets for the culls and for the surplus which cannot be marketed profitably fresh.

The development of new processes for utilizing fruits and vegetables is slow and tedious work, requiring extensive and patient research. The composition of fruits and vegetables as a rule is very complex, and the various chemical substances contained in these products can be determined only by laborious methods.

MYSTERY RELICS FROM MEXICO ARE CENTURIES OLD

Said to be among the oldest relics ever found on the North American continent, curious images of sun-baked clay have been unearthed near Guadalajara, Mexico. They are thought to belong to a period of at least 6,000 years ago, and represent human heads on four-legged bodies, two-headed reptiles and other odd designs. Scholars of the Los Angeles museum are investigating the age and character of the pieces, which were found in volcanic ash about four feet beneath the surface.

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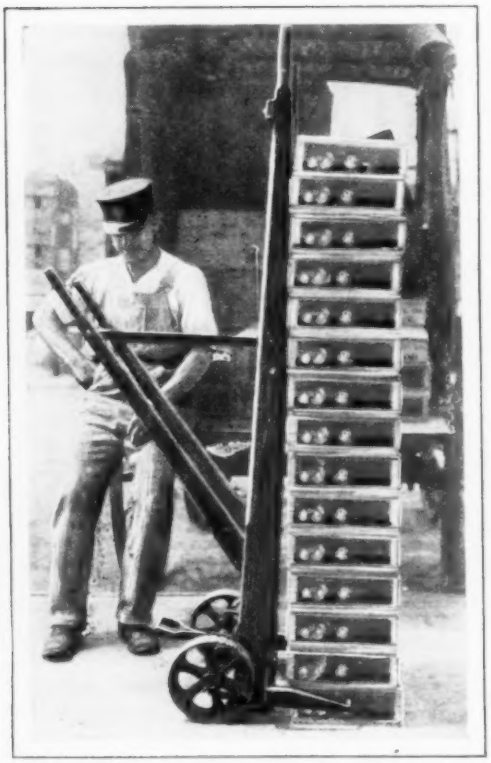


Truck on End, Showing the Foot Lever That Controls the Loading and Unloading Extension

HAND TRUCK LOADED BY LEVER PREVENTS BREAKING BOXES

With the usual type of hand truck, boxes and other articles often are damaged or broken by the sharp blade at the bottom of the carrier. This objection is said to be eliminated in a truck equipped with pointed rods that can be clamped against the bottom box by pressing a lever with the foot so that the load may be tipped on the rack with little difficulty. The rods are easily released for unloading.

FALLING SHUTTER TRAPS THIEF TRYING TO STEAL JEWELS

For the protection of show windows and display cases containing jewelry or other valuable articles, a falling shutter arrangement has been introduced in England to foil the smash-and-grab thieves that have been active there. It can be made to fit almost any shape or size of window or case and is entirely concealed when folded up. Tampering with the glass or frame instantly releases the support for the shutter, which is made of metal, and it falls heavily, cutting or breaking the thief's wrist and setting off an alarm at the same time. The secret of the shutter's operation is a vacuum device that holds it up. The vacuum is destroyed when vibration smashes a glass slide, allowing the heavy shutter to fall.

EYES' SPEED LIMIT

In order to distinguish an object, the average eye must remain in a stationary position for about one-seventh of a second, tests have disclosed. The eye appears to act on a sort of skip-stop system, and no amount of illumination will speed its rate of functioning, the experimenters found. One of the interesting facts revealed by the tests was that most homes and factories are not brightly enough lighted to enable the eye to work as rapidly as it would function under the most favorable conditions of illumination.

CLEAN BUILDINGS WITH STEAM INSTEAD OF SANDBLAST

Jets of live steam as a substitute for sandblast and acid washes have been used by the bureau of standards in cleaning a building in Washington, D. C. The force of the vapor is controlled through a special nozzle, and parts that cannot ordinarily be easily reached are said to be cleaned thoroughly by the steam.

Scouring Building's Decorations with Blast of Steam; an Advantage Is That Crevices Are Cleaned

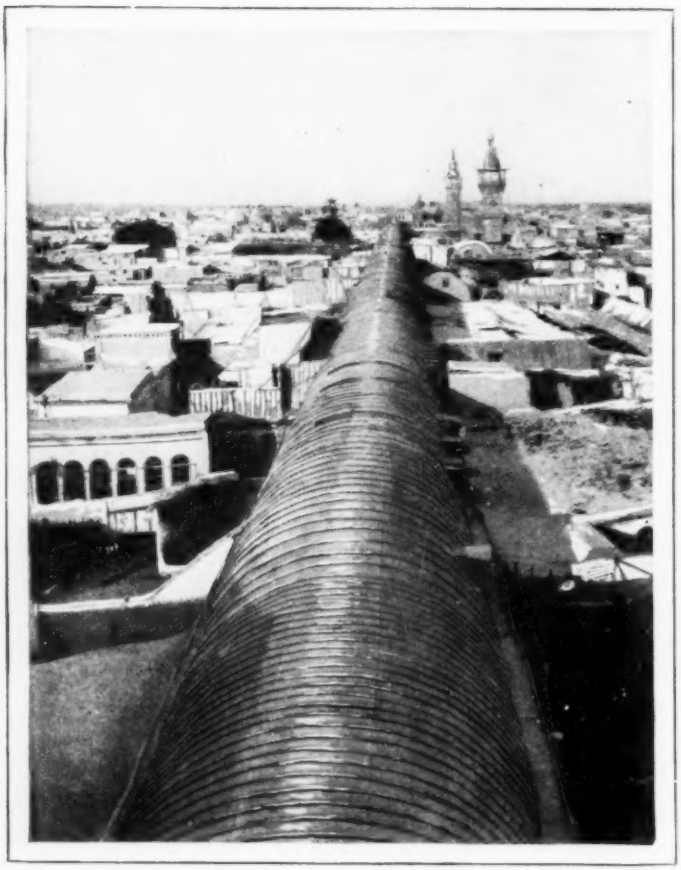
THEATER ON WHEELS ENLIVENS PLAYGROUNDS

Arranging Scenery on the Stage of the "Vagabond" Theater, a Trailer Towed by a Motor Truck; It Makes the Rounds of Playgrounds in Oakland, Calif., to Entertain Hundreds of Children

Completely contained on a trailer, and towed by a motor truck, a "vagabond" theater, built by the playgrounds department of Oakland, Calif., entertains audiences of 200 to 500 children every weekday afternoon in the fifty-two playgrounds of that city. Stage, scenery, plays and acting are all done by the boys and girls of the grammar and junior high schools, and the same play is never presented twice by the same children, so that all the youngsters are given an opportunity to write plays, in competition, and to act them as well. The motor-truck theater, which is believed to be the first of its kind ever built, is simple in construction. The floor of the stage consists of two sections, hinged down their length, one-half being bolted to the chassis of the trailer. The upper half is equipped with folding steel legs along the outer rim and, when not in use, folds over on the lower half, which forms the bed of the trailer. A motor truck, which carries the scenery, costumes and other equipment, tows this trailer. The hinged side of the stage floor is placed next the audience and the upper half swung over to rest on the folding legs. A looped curtain is then draped around it, covering the wheels of the trailer and the legs of the forward half of the stage. Holes in the stage engage pegs in the lower edge of the scenery, backdrops and stage "props." Complete setting of the stage for an indoor play requires only fifteen minutes, while that for an outdoor scene takes somewhat longer. The plays, which never require more than twenty minutes in presentation, are written by pupils of the junior high schools.

GOLF TEE AND SCORE PENCIL COMBINED IN ONE

One of the latest novelties for golf is a convenient tee, the sharp point of which contains a lead for writing the score. The pencil is made in two colors, red and yellow, is always accessible and saves the trouble of carrying an extra article.



Canopy over Damascus Street Gives the Effect of a Huge Pipe Line; It Is Strongly Constructed to Withstand Winds

COVERED STREET IN DAMASCUS RESEMBLES PIPE LINE

Over the famed "street called Straight" in Damascus, a canopy has been erected so that, on first glance from an elevated position, the way has the appearance of a huge pipe line with braces at regular intervals. The covering shields pedestrians from the heat of the sun and is strongly built to withstand the winds.

RUBBER WALLS FOR OFFICES TO REDUCE NOISE

Rubber walls in office buildings to decrease vibrations, and streets and sidewalks paved with rubber, are among the recent uses chemists have found for the product. They have also adapted the material to the making of interior decorations and for coating silk and other fabrics so that scarcely a trace of the resilient substance can be detected. The rubber for use in buildings is in the form of blocks or slabs which are built up vertically on the wall face. According to the inventor of the process, it affords a screen or buffer in which all vibrations expend themselves.

RULE ON MIRROR TELLS YOUR HEIGHT

A fairly accurate measure of a person's height is shown on a ruled mirror especially suited to display in public places or for advertising purposes. The glass is ruled with a scale of inches and the mirror is placed a certain distance from the floor so that a glance in the glass shows how tall you are. The accuracy of the device is based on the fact that the distance from the pupil of the eye to the crown of the head is approximately the same in all people.

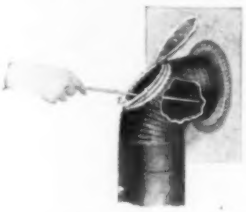
Mirror Gauge That Tells Height in Position for Use

GAUGE SHOWS RECORD RAINFALL OVER INCH A MINUTE

Up to the time of this writing, the world's record rainfall was observed in a district on the west front of the San Gabriel range. Here, on April 5, 1926, a fall of 1.02 inches in one minute was measured on a weighing rain gauge and was reported by the United States weather bureau and the Los Angeles county flood-control commission, joint operators of the observation station. By chance, a second gauge of the same pattern had been installed near the other, for test purposes, and as both instruments made the same record, additional testimony of its accuracy was afforded. The previous rainfall record was observed in Panama. On Nov. 29, 1911, a fall of 2.47 inches was registered in three minutes at the weather station in Porto Bello.

SAFETY FLUE IN STOVEPIPE REDUCES FIRE HAZARD

Soot and rubbish accumulating in the stovepipe elbow are usually removed only with considerable trouble and constitute a fire hazard but can now be quickly taken out through a safety flue, an opening in front of the elbow. It eliminates the necessity of lifting the pipe out and also serves as a check damper for use in case the pipe becomes too hot. In addition, by insuring a constantly clean opening, it saves fuel.



WINDOW CLEANED FROM INSIDE THROUGH INSET PANE

Both upper and lower panes can be cleaned from the inside through the swinging center of a window recently introduced especially for office buildings, hospitals, schools and similar installations. It can be placed in any style of sash, old or new, is made in bronze or aluminum and also serves as a ventilator. The outside of the entire window frame and sash can be painted through the swinging pane,

Showing How Simple It Is to Clean the Outside of the Window from Within through Inset Pane

saving the erection of special scaffolding and, in washing the windows, the hazards and trouble of climbing on the outer sill are done away with.

ELECTRIC FAN MAKES OZONE TO PURIFY AIR

Purification as well as circulation of the air is sought in an electric fan recently introduced in France. It produces ozone from a small generator attached to it, the gas being blown outward by the rapidly revolving blades. Ozone is used in sterilizing water and may sometimes be detected by its odor after a flash of lightning.

¶Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.

One of the Exercises on the Weight-Reducing Puller; It Develops Strength and Grace While Helping to Remove Superfluous Fat

REDUCING EXERCISER ALSO DEVELOPS ARM MUSCLES

Superfluous fat is said to be removed from the waist line and the muscles of the arms receive beneficial exercise by a gymnasium unit especially for the home. It consists chiefly of a cord on a friction reel which furnishes sufficient resistance when the rope is pulled to require considerable effort on the part of the user. An advantage of the exerciser is that the user can sit or stand in several positions.

SEAPLANE PONTOON IS TURNED INTO FLYING BOAT

Increased utility of the seaplane is promised in a three-pontoon flying machine. The center one is detachable and serves as a boat to which an outboard motor may be attached to simplify the task of landing or getting back to the plane. The other two pontoons are sufficient to support the ship. The removable unit is secured to the craft by four bolts and, with its motor attached, may be used to maneuver the plane independent of the big engine. The pontoon may also serve commercial craft for conveying cargo to and from shore.

Pontoon of Flying Boat, Which Serves as Separate Craft

MUDGUARDS FOR SHOE HEELS EASILY DETACHED

To keep mud from soiling the backs of women's shoes, a French shoemaker has introduced a guard that is quickly attached to the rear of the heel and may be removed before entering the house. It is made of transparent material so that it is hardly noticeable, and is shaped to keep the mud down off the shoe even if the heel sinks in. The guard is also adaptable to men's shoes and helps keep the trouser bottoms from becoming soiled and, consequently, worn out quickly.

MYSTERY OF SATURN'S RINGS EXPLAINED BY METEORS?

Little is known for a certainty about the rings of Saturn, but one explanation is that they consist of small solid pieces like meteors, shining by reflected sunlight. Although they are but a few miles thick, they are 173,000 miles across. Viewed edgewise, they disappear even under powerful telescopes and are clearly seen only when they are tilted. Their origin is obscure. Some scholars believe they are survivals of rings which encircled all planets.

SOUND WAVES SAVE SHIPS

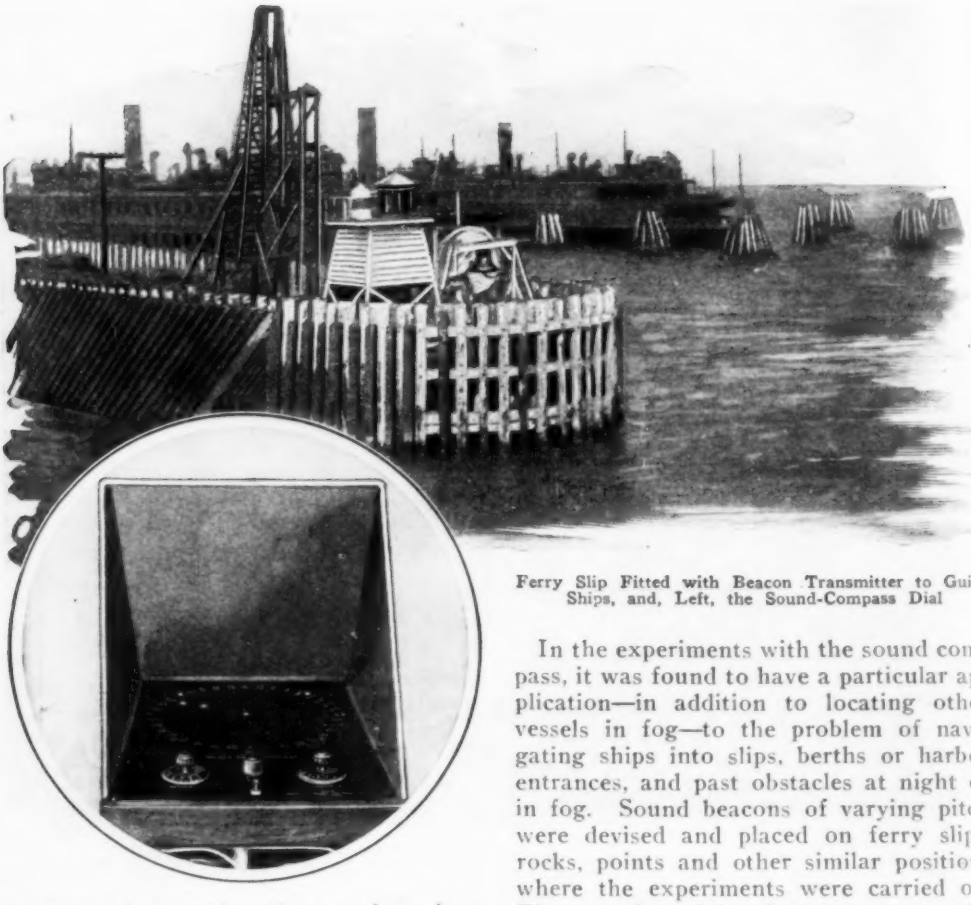
THROUGH fog so thick that the lookout on the bow could not see the stern, a ferryboat carrying 800 passengers crept across San Francisco bay. In the pilothouse, the captain at the wheel, with the first and second officers on either side of him, watched two small, square-topped black boxes, or peered through the windows, while the third officer played searchlights against the gray wall that loomed ahead of the vessel.

Suddenly a brilliant red light glowed for an instant on the revolving disk atop one of the boxes. In a fraction of a second, a similar light flashed on the other box. An indicator needle, spinning between the two, stopped at 700 feet. The red lights flashed again, both seemingly in the same direction. At the first flash, on the port bow, the captain spun his wheel to starboard, and, through his pilothouse controls, drove his heavy propelling motors full speed ahead.

Hardly had the ferryboat changed her course, when, so close that a marble could have been tossed on board, an express liner, in from the Pacific, rushed by at top speed. Had the ferry continued her course, she would have been shattered by the great steamer. The newest life preserver of the sea—the sound compass—had saved her.

Running automatically, constantly telling the direction and distance of sounds and signals, this new device is being given exhaustive tests on some of the forty-one ferryboats which, day and night, weave their way across the Bay of St. Francis, and the above incident is only one of several unexpected, and undesired, demonstrations of its value.

The sound compass consists essentially of a receiving device in the form of a hollow half globe, mounted on a rotating shaft. Attached to the same shaft, either directly or by gearing or remote electrical drive, is an indicator. This is so arranged that it rotates at exactly the



Ferry Slip Fitted with Beacon Transmitter to Guide Ships, and, Left, the Sound-Compass Dial

same angular speed as the sound receiver. The indicator consists of a vacuum bulb filled with a gas, such as neon, which will glow brightly when excited by an electric current. The sound-receiving device is arranged to convert the vibrations received by it into electrical vibrations, which are amplified, if great sensitivity is required, and then transmitted to the indicator, where they cause the lamp on the disk to flash.

Assume, now, that a whistle is being blown continuously at a distance from the vessel. The sound-receiving device, as it rotates, comes into a position where it is strongly actuated by the vibrations from the whistle. The glow lamp on the rotating indicator then flashes, and, being in the same angular position as the sound receiver, the observer, by locating the flash, may read from the indicator the bearing of the sound with respect to his ship.

In the experiments with the sound compass, it was found to have a particular application—in addition to locating other vessels in fog—to the problem of navigating ships into slips, berths or harbor entrances, and past obstacles at night or in fog. Sound beacons of varying pitch were devised and placed on ferry slips, rocks, points and other similar positions where the experiments were carried on. The sound-receiving instruments, on the boats on which the trials were made, were particularly sensitized to different individual sound beacons, without interfering with the ability of the receiver to pick up whistles from other vessels and indicate their direction. It was found that each ferry captain knew at all times the bearing of his slip on the opposite side of the bay, a distance of about four miles. Warning also was automatically laid before him of a point on an island along his course across the bay, on which one of the sound beacons was located.

One feature of particular interest is the accuracy with which the sound-locating device performs when the frequency of pitch of the sound beacon is increased. Signals, of a pitch far too high to be heard by the human ear, instantly attract the attention of the sound receiver and appear brilliantly in the neon light on the in-

dicator in the pilothouse. This provides a means whereby sound beacons of a pitch beyond, say, 15,000 vibrations a second, may be maintained in continuous operation without in any way interfering with the use of audible signals. This is of especial value in guiding ships, ferries or tugboats through heavy fog.

The device also may be used to obtain distance as well as direction readings, by mounting two of the devices, one at each end of the bridge of a vessel, and placing their respective indicators side by side in the pilothouse. Readings taken of the two indicators simultaneously may be plotted to give both the direction and distance of the sound.

While the confusion due to the spreading of, or the echo from, a sound in a fog, renders the human sense of hearing somewhat undependable, the sound compass, in such conditions, shows two flashes in the neon light on the indicator—a very strong flash from the direction of the origin of the sound, and a weak flash from the direction of the echo. This makes recognition of the exact direction comparatively easy.

In many ways the sound compass is quite similar to the directional radio beacons being developed to guide airplanes, and possibly the two services may in the future be combined over such frequently fog-shrouded areas as San Francisco. The Golden Gate has been a problem to flyers from the start and for some time the transcontinental air mail did not even approach it.

Receiver of the Sound Compass in Position at the Bow of a Frisco Bay Ferry, and, Above, the Front of the Receiver and the Recording Cabinet to Which It Is Connected

Metal Top for Fish Basket Has Space for Bait, and a Rule That Tells How Big Are the Ones You Catch

METAL TOP FOR FISH BASKET HOLDS HOOKS AND LINES

Shaped to fit any standard-size fish basket, a metal top, one inch thick, holds hooks, lines and other accessories. There is a space in the center compartment for bait and a one-foot measure is marked on one side so that the accurate dimensions of the fish may be obtained. A round lid in the middle of the top can be turned for placing fish in the basket.

CHECK PROTECTOR IN BILL FOLD LATEST MONEY GUARD

Check-book holder, bill fold and check protector are combined in one pocket article recently introduced by a southern manufacturer. After a check is written, it is laid under a hinged metal flap and perforated, at the same time receiving an inking, so that any attempt to erase or alter the original writing will result in smears. The entire unit folds up to fit the pocket and additional fillers of checks are easily inserted.

Check-Protecting Outfit Complete; the Perforating Stencil Unit Is at the Right with the Flap Raised

FLOATING MOUNTAIN OF DUST OVER AMERICAN CITIES

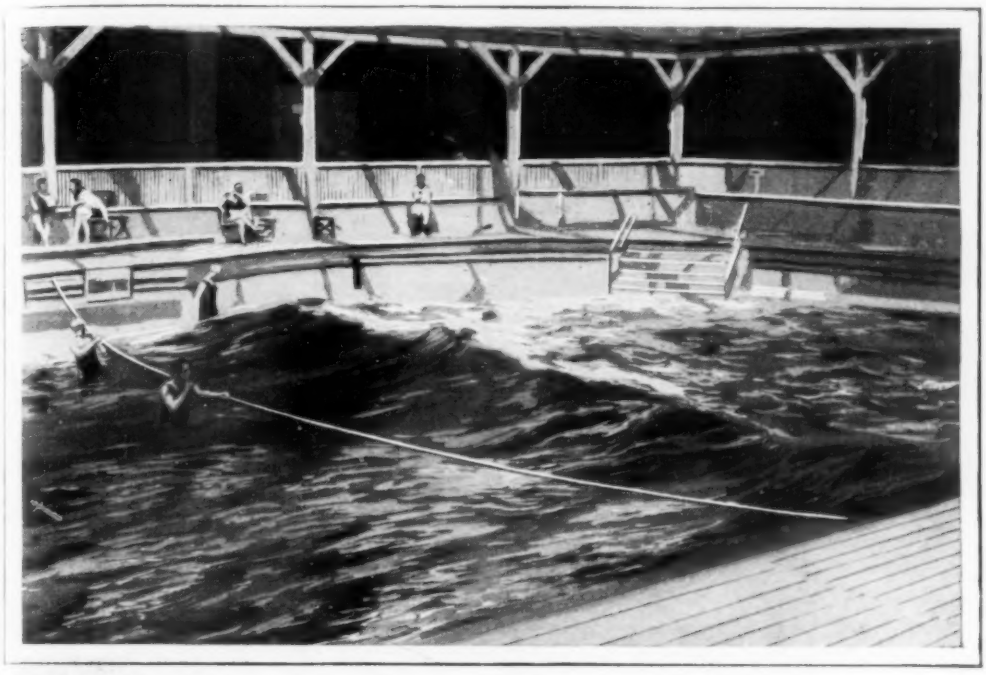
According to reliable estimates, enough soot and dirt float over American cities in one year to bury every street on Manhattan island to a depth of twenty-one feet. It would form a pyramid 1,500 feet high and five miles across at the base, if gathered into one large mass. These calculations have been prepared on actual measurements of the soot and smoke found in the air at different times of the year and over many different cities.

NIGHT FLOOR LIGHT IN WALL HAS GLOW REGULATOR

Subdued illumination for the floors or landings in hospitals, theaters and similar places is provided by an electric lamp installed from twelve to eighteen inches above the flooring. The degree of light displayed up to the maximum capacity of the unit, can be regulated by means of a small screw on the outside. This controls a shutter attachment inside. The light is housed in a metal box which is easily accessible for wiring or repairs, and the glass through which the rays shine is tilted to provide the most satisfactory diffusion and focus.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of our magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished by addressing the bureau.

ARTIFICIAL WAVES ADD THRILLS TO BATHING POOL



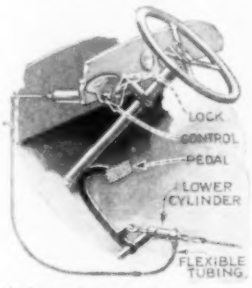
Courtesy The Sphere

Bringing the Pleasures of the Open Beach to the Swimming Pool; Artificial Waves, Formed by Agitator, and a Sandy Shore, Which Add to the Delights of This Berlin Bathing Resort

Pleasures of an ocean beach are afforded patrons of an open-air swimming pool in Berlin. It has a sandy shore and a special wave-making apparatus that produces "breakers" like those of the sea. Besides providing an enjoyable surf, the wave maker helps purify the water.

AUTO BRAKE ADJUSTER ON DASH REDUCES MOTOR HAZARD

Turn a little handle on the dashboard and your brakes are equalized and safely adjusted to the road and weather conditions. This is the claim for a recently introduced motoring accessory quickly attached and simple in operation. It saves tightening bolts or rods, getting out and under the car, and can be used while the auto is in motion. Like the ignition, it can be locked, affording an additional protection against theft, and eliminates waste of time in adjustment of the brakes.

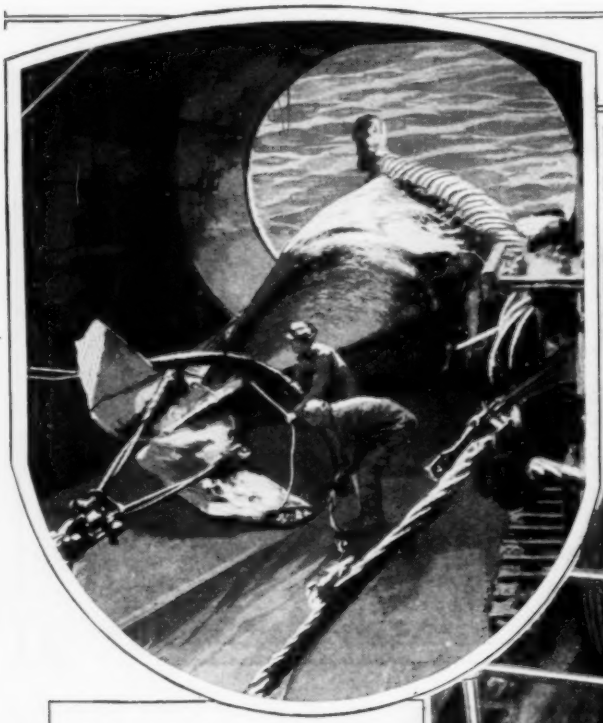


WEATHER "CARDS" FOR AIRMEN PROMOTE FLYING SAFETY

Aviators taking off from the Croydon flying field, the English air port, for the continent, consult the "cards" before a journey, but not for any superstitious reason. The cards, in this case, are disks on a special board, showing what weather conditions will probably be encountered at various points along the route. For instance, one set shows if it is to be clear, raining or snowing, another indicates visibility, a third shows if the clouds are hanging low and a fourth tells the distance between the base of the clouds and the ground. Wind warnings are displayed by a conical sign which is illuminated at night.

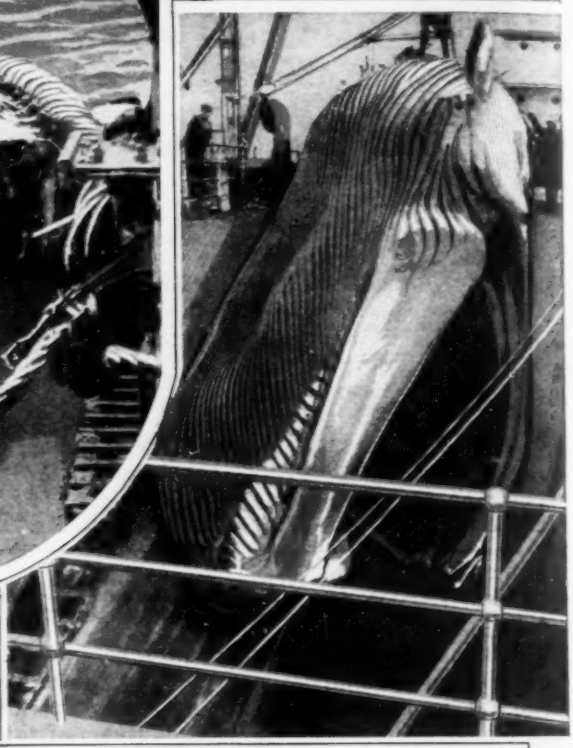
¶Yellowstone national park is visited by more than 200 species of birds annually.

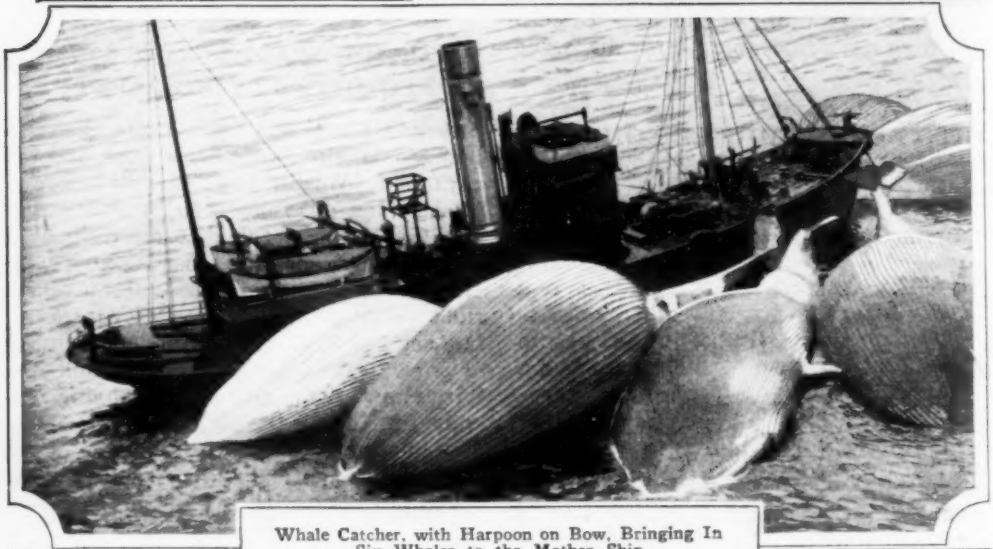
SHIP THAT SWALLOWS WHALES PROVES A SUCCESS



Hauling a Whale through the Door in the "Larsen's" Bow; the Opening, Sixteen Feet in Diameter, Is Big Enough to Accommodate 150-Ton Leviathans of the Deep

Part of a Whale, Being Cut Up; the Picture Shows the Curious Pleated Appearance of a Whale's Underside



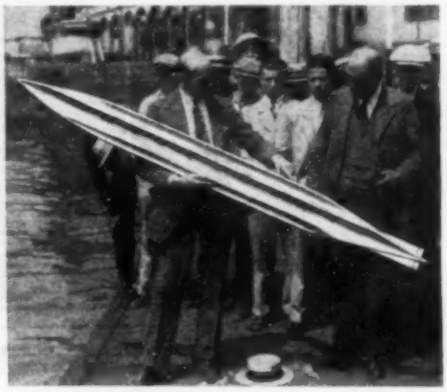


Whale Catcher, with Harpoon on Bow, Bringing In Six Whales to the Mother Ship

FARM PROBLEMS BEING SOLVED BY USE OF MACHINERY

How extensively machinery has reduced hand labor on the farm was forcibly illustrated last season when it was estimated that from 80,000 to 90,000 fewer harvest hands were required in the wheat belt than were necessary a few years ago. Between 1900 and 1927, the number of work horses on farms declined from 21,047,000 to 15,179,000. One student of the question sees the era of machinery transforming the farmer from a grower into a "manufacturer of foodstuffs," and the day of the "agricultural engineer," rather than the farmer, is said to have arrived. Combined wheat harvesters, that cut and thresh the grain in one operation, mechanical corn huskers and cotton pickers are among the units that are supplanting hand work in the larger agricultural tasks, while the tractor has lightened considerably the burden of the small farmer in all parts of the country. As the use of machinery makes further development of land practical, several interesting effects are noticed. One is that still larger production of wheat is assured, keeping prices low and thus making its growing unprofitable to the owner of high-priced land. In Texas and other parts of the south, still larger cultivation of cotton is predicted as a result of improved picking equipment. In 1790, at the time of the first census, the work of seven rural families was required to supply one townsman with food and raw materials. At present, seven rural families supply about eighty-four townspeople. In 1820, it took sixty hours of man labor to bring an acre of corn through the crop cycle by hand methods. At the present time, with improved machinery, the work can be done in five man-hours. Similar savings have been effected in other crops.

Odd Totem Pole of Today; Worn-Out Auto Tires Stacked near Desert Highway; a Garage Owner Sells the Yearly Offerings for Junk



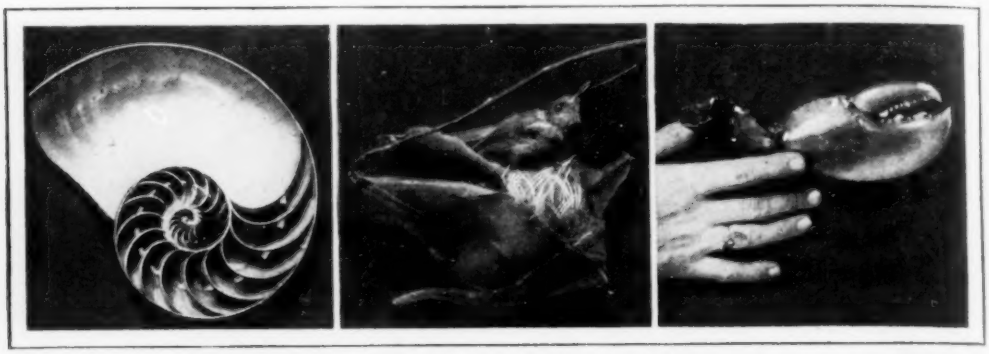
Model of Boat Body for Fast Atlantic Trips; It Is Expected to Make 180 Miles an Hour

SPEED BOAT TO CROSS OCEAN IN TWENTY-FOUR HOURS

Trips across the Atlantic ocean can be made in twenty-four hours, an eastern inventor hopes, in a special speed boat he is designing. He expects the craft to develop a speed of 180 miles an hour. As indicated by the small model he is shown demonstrating here, the body of the boat is long and slender with grooved bottom intended to decrease the resistance of the water.

"TOTEM POLE" OF USED AUTO TIRES MARKS DESERT ROAD

Tribute is paid to the "Great Spirit of Departed Mileage" in an odd totem pole on the road between Needles and Los Angeles. It is formed of old auto tires, many worn out from desert travel. Tourists add their contributions to the lot and, last year, a garage owner is said to have sold 300 tires from it as junk.



Three of Nature's Inventions, the Original Pneumatic Tube Connecting the Chambers of the Pearly Nautilus; the Tailor Bird Stitching Leaves Together, and the Lobster's Fine Pincers

Queer Things in Nature's Patent Office

How Man's Mechanical and Other Contrivances Follow along the Lines of Things Known Ages Ago

By RENE BACHE

NATURE is the great inventor. Hers was the first patent office. To a very large extent, man's mechanical and other contrivances follow the lines of her ideas.

Nature solved the flying problem ages ago. Langley, in working out the problem of the airplane, studied the soaring flight of buzzards from the top of a tall wooden tower. A dirigible balloon in the air looks remarkably like a gigantic fish. It is streamlined in the same way for swiftness, and there is a fish that resembles a balloon. It is the swellfish, about eight inches long, a common species in Chesapeake bay. When caught on a hook, it inflates itself to almost spherical shape by taking in air between its parchment-like skin and the muscular coat of its body. Fishermen say that it rises to the top of the water and, inflating itself, is blown along over the waves by the breeze.

The parachute, so valuable a safety contrivance for aviators and balloonists, might well have been suggested by the humble dandelion, whose seeds, to accomplish their dispersal, are wafted far aloft by the winds and carried on long journeys by air, each one kept afloat by the bit of fluff.

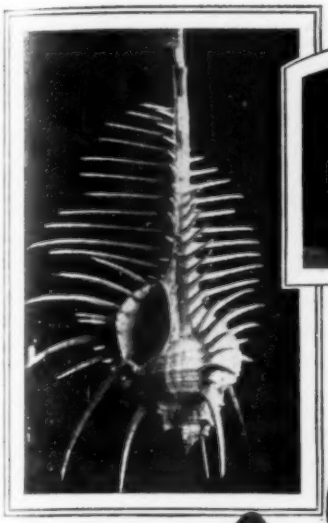
The idea that columns for supporting structures can be rendered much stronger, relative to weight, by making them hollow is comparatively new in engineering but incalculably old in nature, as illustrated by the stems of bamboo and wheat.

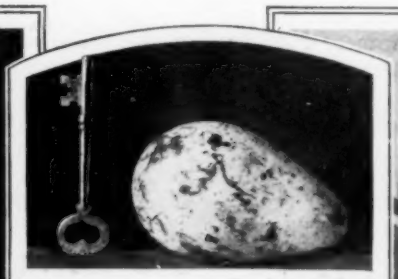
The origin of the screw is lost in the mists of antiquity, yet its form is perfectly illustrated by the interior of the shell of a mollusk called terebra, which, when the outer wall is removed, is absolutely screwlike.

Pumps are now in use that are modeled closely after the human heart, with a similar arrangement of valves. The ball-and-socket joint is a familiar device in nature as it is with that kind of joint that a man's arms and legs are joined to his body.

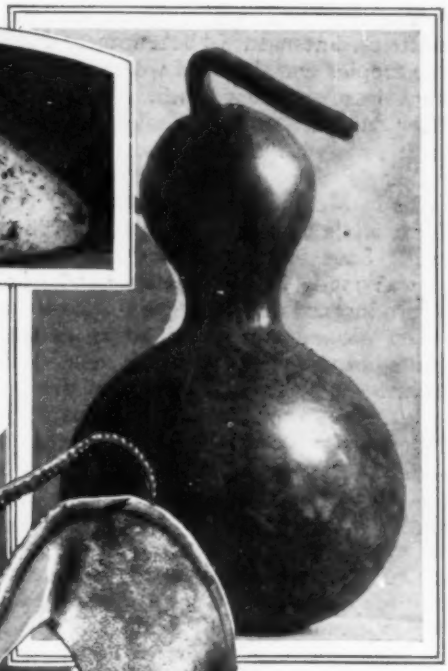
Who was it that first thought of a hinge? Doubtless some prehistoric person who ate an oyster or a clam. The shell of every bivalve mollusk has its hinge.

In a relative sense, our acquaintance with electricity is new. Storage batteries have been developed only within recent years. Yet such batteries, of high efficiency, were in existence millions of years ago, and are in use today by certain fishes. The torpedo ray, a common species in the deeper waters of Buzzards bay and Vineyard sound, is a terror to fishermen, being able to deliver a shock that will knock a man down. The creature carries two storage batteries, one on each side of its head. They are large oval masses composed of cells filled with a jellylike substance.



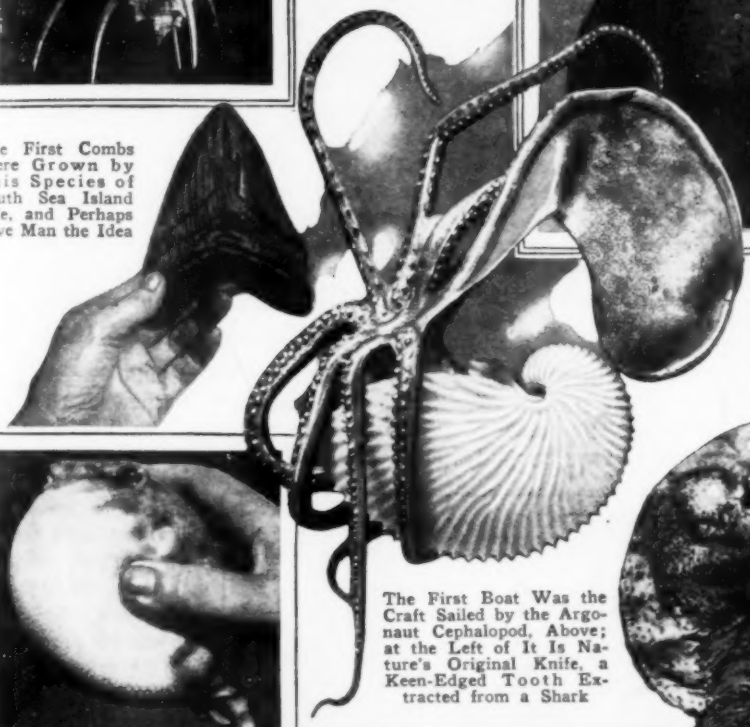


Nature's Invention, in an Egg, of a Rounded Box That Cannot Roll Off a Shelf, as It Can Only Roll in a Circle



Above Is the First Bottle, Another of Nature's Inventions; in This Case the Common Gourd, Still Used as a Liquid Container

The First Combs Were Grown by This Species of South Sea Island Life, and Perhaps Gave Man the Idea



The First Boat Was the Craft Sailed by the Argonaut Cephalopod, Above; at the Left of It Is Nature's Original Knife, a Keen-Edged Tooth Extracted from a Shark

Above Is the Original Balloon, a Swellfish, Which Blows Itself Up with Air; at the Right Is Nature's Patent-Office Model of a Spinning Machine, the Caterpillar, Which Produces Silk and Spins It into a Cocoon; Above the Caterpillar Is a Pre-Edison Electric Battery, in the Form of a Torpedo Ray, with a Shocking Sting

Weaving was one of man's earliest industries, but nature "beat him to it." In the tropics certain trees weave their inner bark into excellent cloth, the strands of fiber laid crisscross to make woof and weft, as if with deft fingers.

Nearly three centuries ago, the Spaniards in Mexico sent to the king of Spain, for a birthday gift, a magnificent collar of lace. Save for the shaping and finishing, it was made by no human hands, being a product of the lace tree, whose bark, when soaked for many hours in water, splits into layers. Another very ancient industry is pottery making. But the potter wasp made the daintiest imaginable pottery ages before man first knew the need of vessels for food and water.

The first bottle was a gourd. Every egg is a neatly made box, and so likewise is every nut. The egg of a seafowl, called the murre, in itself represents a curious invention—that of a rounded box which cannot roll off a shelf. The hen bird lays her eggs on bare and often narrow ledges of lofty cliffs, off which they would be likely to roll were it not for the fact that, being pointed at one end, they roll in a circle when disturbed.

The tailor bird, a species of finch, might have been the first teacher of the art of sewing. It makes its nest by sewing leaves together. Caterpillars may be said to have invented spinning. In the manufacture of the artificial silk called rayon, the machines imitate the spinning apparatus of the silkworm.

The earliest comb was a molluscan shell (still used for that purpose by natives of Polynesia), which is ornamented with long spines arranged in rows. For ages wasps have built their nests of paper made from woodpulp. Nature was the first manufacturer of glass, which is produced in enormous quantities by volcanoes from melted quartz rock.

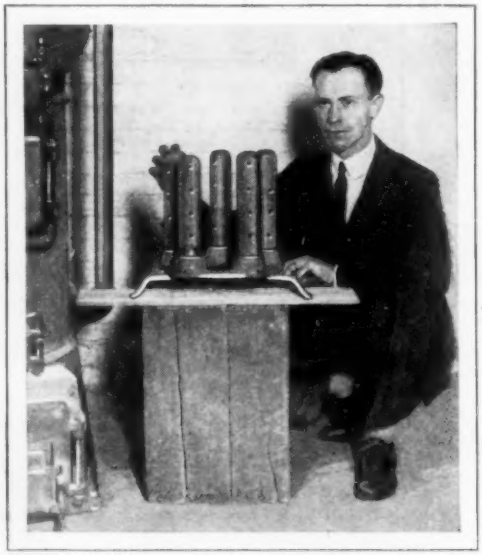
All of the evolution of life, both animal and vegetable, on earth has been a history of invention, with innumerable experiments, many of them eventually rejected, while those that proved successful have been retained.

SHIP METAL OF LIGHT WEIGHT TO MEET NAVY PROBLEM

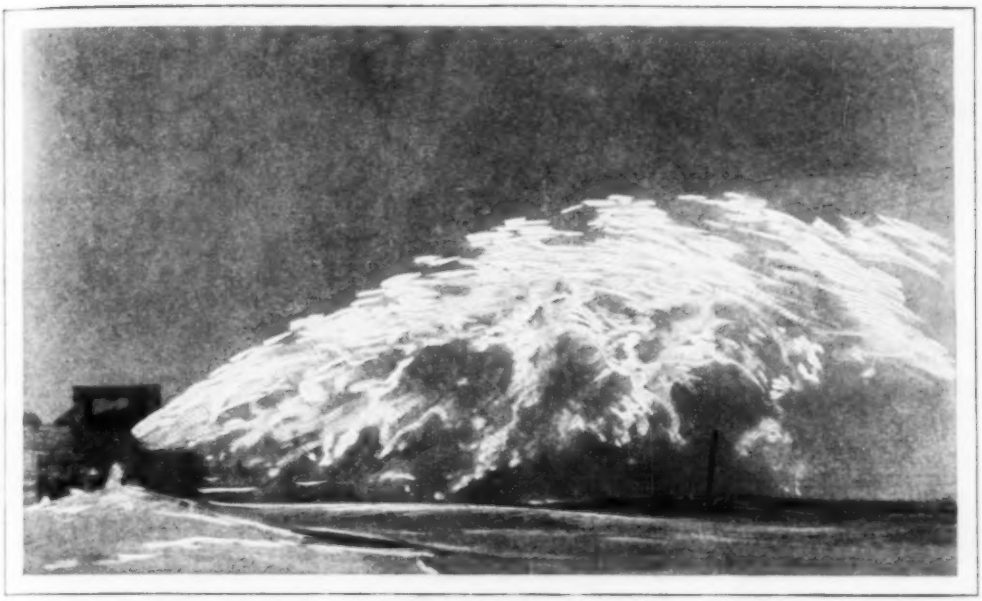
While the question of total tonnage for navies has proved a perplexing international problem, the Japanese are reported to have discovered a strong, lightweight steel alloy which will permit them to build more ships than would be possible with ordinary materials under restrictive regulations. It is said to be extremely hard, but will reduce the weight of a vessel by nearly half. The Japanese naval department is maintaining great secrecy concerning the alloy, and officials would neither confirm nor deny the report.

"BREATHING-TUBE" FURNACE TO REDUCE COAL BILLS

Buckwheat and other small sizes of coal can be economically burned in the ordinary furnace without the likelihood of smothering the fire, according to claims made for a combustion unit devised by a scientist of the department of agriculture. It is essentially a series of tubes so perforated that when it is placed in the furnace firebox, a strong draft is afforded, giving sufficient oxygen for the burning of powdered fuel. As this kind generally sells at much lower prices than the lump variety, a saving for the consumer is open without the expense of remodeling his furnace.



Air Tubes for the Furnace, to Permit Burning of Small-Size Coal; They Increase Oxygen Supply



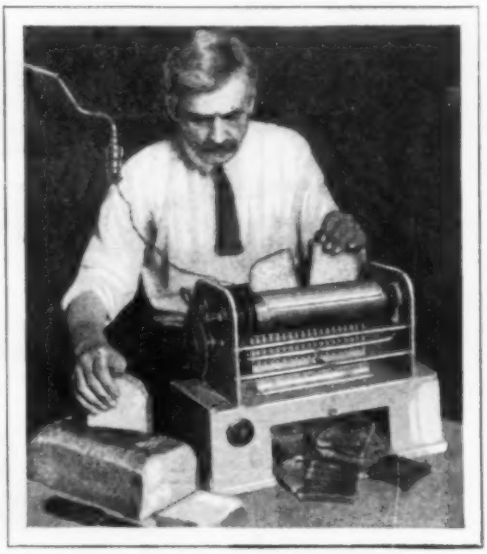
Boring through a Drift and Throwing the Snow over the Fence; the Machine in Action, Illustrating Its Powerful Blowing Force; It Is Said to Operate Effectively in All Kinds of Snow

SNOW CUTTER AND BLOWER QUICKLY CLEARS ROADS

Snow of any depth, whether dry, wet, hard or loose, is quickly removed from roads with a combined cutter and blower unit that is said to have performed satisfactorily under practically all conditions of snow and roads. Tempered cutting augers bore into the drifts, break them up and by the forward movement of the machine, the snow is forced against a powerful blower that hurls it over fences, completely off the roadway, to the right or left, high or low. The outfit is made as a complete unit, only one motor being required to operate the augers and the blower, and to propel the machine. An additional feature is that snow is removed from the sides of the roads to permit drainage during thaws.

SLICE OF TOAST IN TWO SECONDS ON QUICK-ACTION TOASTER

Toast at the rate of twenty-four to fifty slices per minute, depending upon the condition of the bread, is browned in an electric unit for which patents have been sought. It has rollers like those of a wringer. A piece of bread is dropped between them and pops out at the bottom, evenly and thoroughly toasted, due to the action of heat from the rolls, which run on graphite bearings that serve as brushes to take off the current. One roller swings on a pivot, permitting variation in thickness of the slices from one-quarter of an inch to an inch.

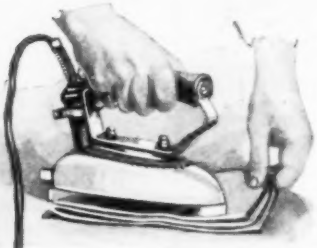


Toasting Bread in the Roller Unit; Speed and Even Browning Are Special Features of the Machine

To Save Work in your Home

Light May Be Directed at Any Angle from This Floor Lamp for Many Purposes; One Bulb Is Sufficient

Rapid Comb Cleaner Gets between Teeth



Electric Iron with Special Stand Shuts Itself Off If It Becomes Overheated

Left, Adjustable Glove-Drying Racks Fit Any Size and Prevent Wrinkles and Shrinking

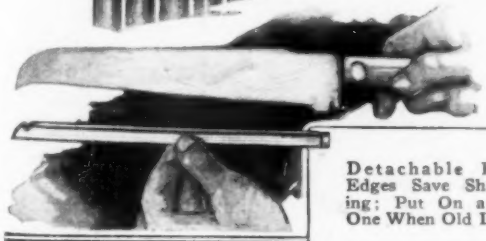
Right, Jumper Seat for Baby Is Safe, Gives Healthful Exercise and Keeps Him from Floor

Kitchen Cabinet, in Addition to the Regular Porcelain-Top Worktable, Has a Sliding One for Meals with Room Enough to Accommodate Four Persons in the Larger Models

For Convenience and Added Cleanliness, Metal Cover for the Milk Bottle Has Space for Coins or Tickets and Can Be Used Practically Indefinitely

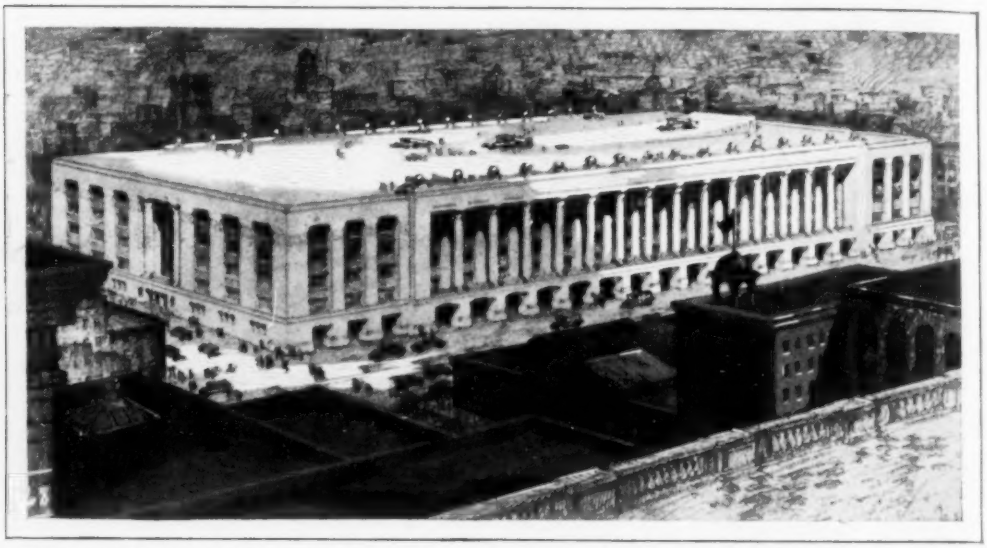
Using Heat from Radiator for Drying Clothes; Three-Armed Rack Is Quickly Adjusted and Prevents Soiling of the Garments While Drying

Below, Grinder for Sharpening Shears or Knives Does the Work Quickly and Easily



Detachable Knife Edges Save Sharpening; Put On a New One When Old Is Dull

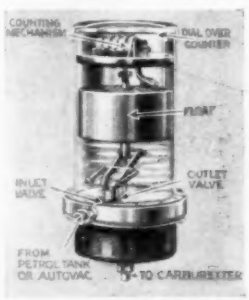
AIR LANDING PLANNED FOR POST-OFFICE ROOF



Drawing of New Post-Office Building for Chicago, Showing Landing Facilities for Airplanes on the Roof; the Plan Would Save a Separate Haul by Motor Trucks and Speed Schedules

Fleets of airplanes taking off and alighting on the roofs of office buildings, and other small spaces, will be possible, it is believed, by the utilization of two improvements just added to the long list of inventions by C. Francis Jenkins of Washington, D. C. One is a special launching runway, not unlike the "dips" at amusement parks, while the other is a "brake" or means for reversing the propeller. Already, plans have been made to adapt these features to mail planes, and it is proposed that ships shall land on the roof of the new post-office building under way for Chicago. Mr. Jenkins explains that the idea of the reversing propeller is not new but has been considered too dangerous for airplane use, since the pilot might accidentally pull the controlling lever during flight, resulting in a crash. An essential feature of the new brake is that the reversing lever is so geared that it cannot be moved while the plane is in the air. As soon as it alights, a spring automatically releases the safety guard on the control, and the aviator is free to bring his plane to rest almost as abruptly as a bird ceases its flight. The take-off device is merely a runway built on the roller-coaster idea. Taking advantage of the gravitational acceleration, plus the momentum gained by the motor, the plane can easily attain flying speed by the end of the first second, it is estimated. On the runway, the plane is adjusted to give little resistance as it plunges downward, and the control stick is held at a climbing angle from the start, so that the ship leaves as soon as flying speed is attained and immediately starts to climb. Mr. Jenkins believes this can be used on "mother ships" and small fields.

FUEL METER FOR AUTOMOBILE REGISTERS WASTE



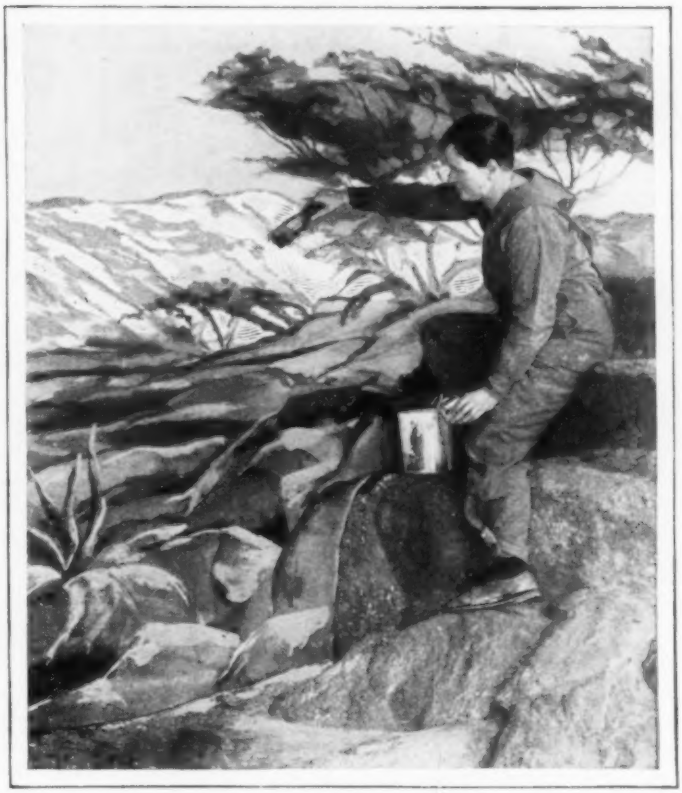
Accurate measurement of the amount of fuel required by the auto engine in going a certain distance is made in a special meter recently introduced in England. It is fitted between the tank and the carburetor and records the rate of fuel consumption by the twentieth of a gallon each forty seconds, up to a total of 10,000 gallons, and then repeats. By checking this record, the driver can tell if the motor functions properly, or if

here is any waste of fuel from some unknown cause. The instrument is said to be accurate within two per cent, is easily attached and will operate with practically any liquid that flows through a pipe with reasonable speed.

BOW AND ARROW TRAP INSECTS

"Shooting" insects with a bow and arrow suggests an impractical method, especially when some of the game is so small that it can hardly be seen by the unaided eye, but this is the way one of the government scientists obtains specimens for the National museum. The feathers on the arrows are smeared with liquid glue and the shaft is shot into swarms of insects flying over tree tops and in other places difficult to reach. As it passes through the swarm, the insects are trapped on the glue and fall to the ground with the arrow. Although some are shaken off, enough are left to serve the collector's purposes. By this method, species of high-flying insects, rarely collected before, are caught.

Bow and Arrow Equipment Used in Collecting Insects; Glue on the Feathers Traps Specimens in the Air



Constructing Realistic Backgrounds for Specimens in New York's Outdoor Animal Cages; Woman Painter at Work on Scenic Detail

PAINTING SCENERY FOR LIONS WOMAN'S NOVEL TASK

Painting jungle scenes in the outdoor cage for the lions at the New York zoological garden, is a woman artist's specialty. The decorations are said to make the beasts feel more at home.

SURVEYORS HELPED BY COLORS USED ON SIGHT CARDS

Engineers surveying for a cabin site in the mountains, near Seattle, Wash., had difficulty in using their instruments as the darkness of the woods made it hard to take the readings from the sight card beyond a few hundred feet. An artist utilized his knowledge of color values to make a new card that could be seen more than 1,000 feet away with little trouble. Instead of having the usual four-square pattern in contrasting colors, his card was of red with a vertical bar in the center.

Manne, with Some of the Instruments Used in Theater for Making Interpretative Noises to Accompany Productions

EXPERT IN NOISE MAKING ADDS JOY TO THEATERGOING

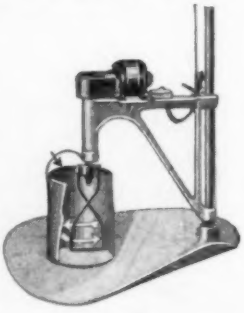
To make as much noise as he can and in as many different ways as possible is the task of Max H. Manne, who produces sound effects to accompany the films and feature numbers at Roxy's theater. Wire brushes rubbed over the kettledrum, give the effect of a locomotive's noise; a reed whistle has been made to imitate an infant's cry; catgut, variously used, mimics the calls of a number of animals and, to reproduce a dog's bark, a string drawn through a tin can and caressed by rosined fingers is effective. Mr. Manne has been granted a number of patents on noise makers, and the percussion room of the theater, where articles are stored, is an interesting museum of musical novelties.

¶The weight of tungsten is about twice that of lead.

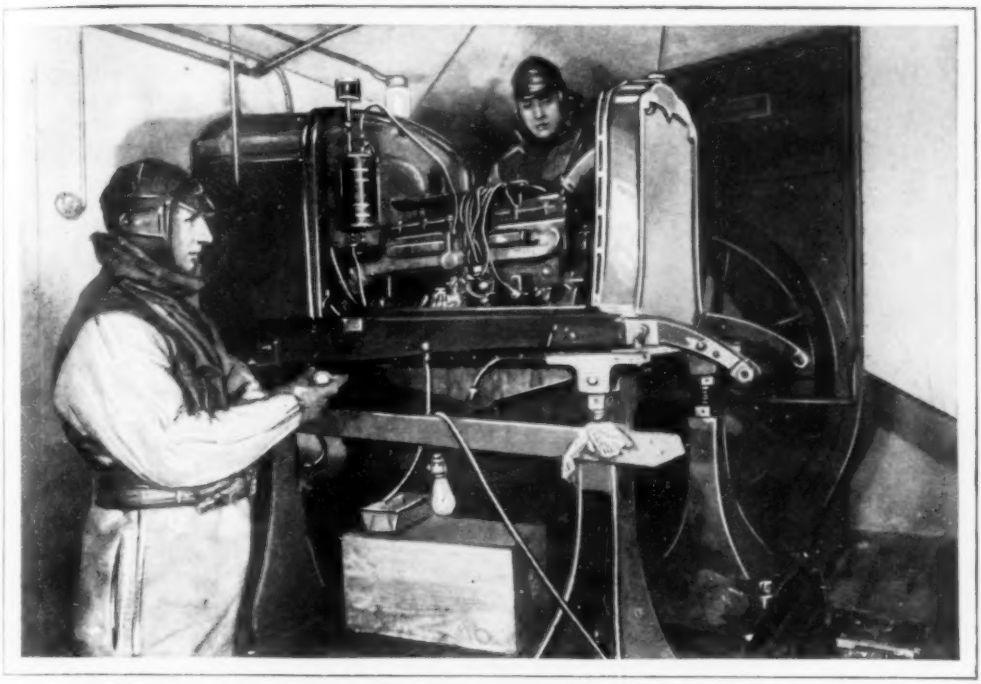
STUDY QUICKER BERRY PICKING TO REDUCE FARMING COSTS

Farming costs in Great Britain can be reduced without a corresponding reduction in wages, according to findings of experts who recently completed a series of tests on workers with a view to abolishing antiquated and inefficient methods. Strawberry pickers were observed with special care. It was found that a fast picker spent more than half an hour in actually picking and seventeen minutes fumbling at the leaves. Slow pickers spent over a quarter of an hour hesitating with the leaves. They increased their output rate by picking more than one berry at a time before bringing the hand back to the receptacle; by using both hands, keeping the basket as near to the bush as possible, and refraining from "dodging about." For currant pickers, a special stool was introduced. It could be adjusted to three different heights and was also adapted to use in the packing sheds. The investigators found that women are superior to men in handling milk cows, especially when the animals are restless, because the women speak to them more often than men and in soothing voices.

ELECTRIC PAINT MIXER WORKS FROM LIGHTING SOCKET



Saving of time, labor and materials is claimed for a paint mixer, an electric motor which operates with current from the lighting socket. It is furnished in a floor or wall model, parts of which are interchangeable, and is adapted to a wide variety of other mixing operations.



Clad in Aviator's Fur Suits, Testers in the Subzero Room of Automobile-Test Grounds Operate Sample Engines under the Most Trying Conditions to Which They Can Be Subjected

Breaking 'em Up to Make Them Better

How Scientists Devise Destructive Tests to Find New Methods of Improving Your Car

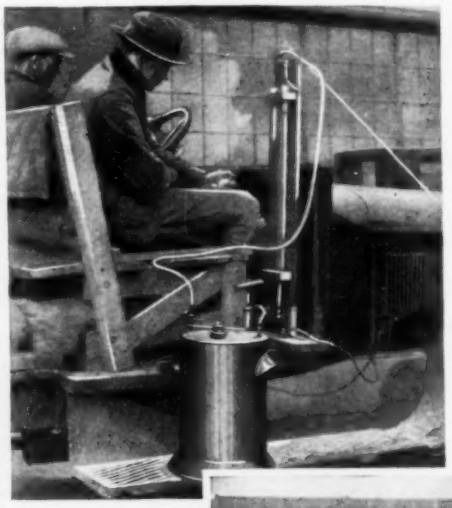
THAT mythical raincoat salesman, with the Sahara desert as his territory, has nothing on the experts in the laboratories of the big Detroit automobile factories, for their intricate devices, made by the score, have no market beyond their own workshops and no one bothers about seeking patents on them.

"We are always inventing ways to wreck cars," explained L. A. Danse, chief metal expert for a factory producing one of the highest-priced cars. "Inventors in the past have centered their efforts on means to make automobiles; none saw the necessity of breaking them up."

Mr. Danse pointed to a device for breaking a steering rod. "The average break comes when a front wheel hits an unexpected rut," he explained. "Well, we had to invent a machine that would duplicate this sort of a jar, not only on the right front wheel but the left. We keep this jarring up, increasing the violence of the jolts until something breaks. The steel at the breaking point is examined and, if feasible, we advise the substitution of a different grade of metal."

Gears and their tendency to strip, have offered no end of opportunity for the experts. The teeth in the gears, Mr. Danse explained, must have a surface made of the hardest steel possible and at the same time, to prevent brittleness, the core must be of softer metal. To test the hardness of the gear tooth's surface, a machine was rigged up in the automobile laboratory. It consists of a tiny diamond ball that is dropped upon the various gear teeth, the rebound of the ball being automatically recorded. The higher the bounce, the harder the steel, explained the engineer.

Just the other day Mr. Danse and his assistants started an experiment in this



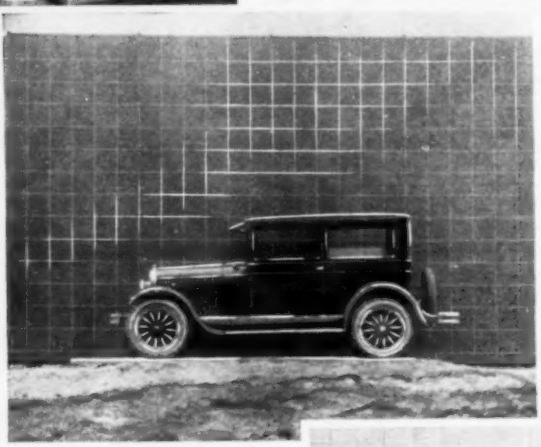
matter of hardening steel for gear teeth. "We'll know whether we are successful or not about two years from now," he said. "This is one of the big problems in the manufacture of automobiles. The present method of hardening surfaces for gears consists in combining carbon with the steel, the steel absorbing the carbon. The gear must undergo an intense heat during the process. The heat must be quenched in water or oil. The trouble lies in the fact that the great heat and the sudden quench invariably cause warp.

"Now we believe that by nitriting the steel instead of carbonizing, the same hardness will result, and there will be no occasion for the tremendous heat nor, therefore, any warping. The automobile of the future, if this thing is done, will have fewer stripped gears."

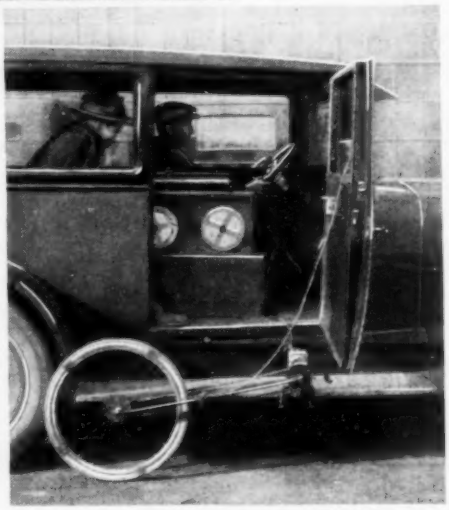
Plowing furrows in fields of polished steel is a method adopted in this remarkable laboratory, with a finer grade of automobile anticipated as the harvest. Steel is shipped into the factory of various grades. Some is meant for gears, others for the cylinders and still others for the chassis. Before any of it is used, however, Danse "goes plowing."

His plowshare is made of a tiny point of sapphire and the steel is polished until it might serve as a mirror. Across the field the sapphire plow is dragged and, by looking closely, one may discern a faint scratch. But, the scratch becomes a great furrow when placed under a microscope that enlarges 4,000 times. In some places deeper tracks are found, and here is where the experts do their work. Tiny crystals are removed from the deeper tracks and examined more closely. They represent the "fatigue point" in steel and, if there are too many of them, the steel is at once rejected.

The microscope itself in this wonder laboratory was



An Accurate Measure of Fuel Consumption Made by Special Apparatus, Top; and Checkered Background against Which Cars Are Photographed to Compare the Contours of Various Makes and Models

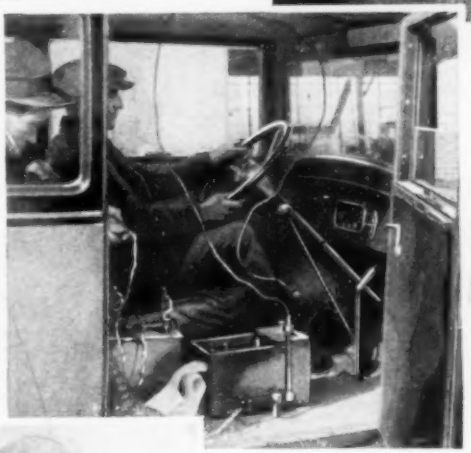


Bicycle Wheel and Chain Drive Operating the Electrical Apparatus That Makes a Written Record of Acceleration Tests at the Proving Grounds

irtually invented by the men who break up cars for a living. It carries, Mr. Danse says, the first binocular eyepiece ever used, the result of failing eyesight of one of the laboratory scientists. It possesses a short illuminant — microscope makers laughed when Danse ordered one—so he made his own. The arc light for the point of light to the center on the specimen has been done away with, and a simpler method substituted, and the whole has been mounted on springs so as to nullify the vibrating influences of a busy factory.

So carefully are steel tests made in the manufacture of automobiles, that in Danse's workshop the set of balances is so delicate that it can give the exact weight of one fiftieth part of an eyelash. Even the heat of an electric bulb influences the weighing of a specimen, and it is a laboratory rule that the light must be kept burning for at least fifteen minutes before the balances are used.

"Here is a contrivance that took considerable time to fix up," said Mr. Danse, pointing to a roaring mechanism in one corner of the laboratory. "It's a test for rear-axle gears. We imagined a car driven in low gear up a fifteen-per-cent grade at thirty miles an hour, carrying a heavy load and operating for exactly 2,500 miles. When the machine has run for this distance, we take off the gears, break them up and find out which portions are worn most."



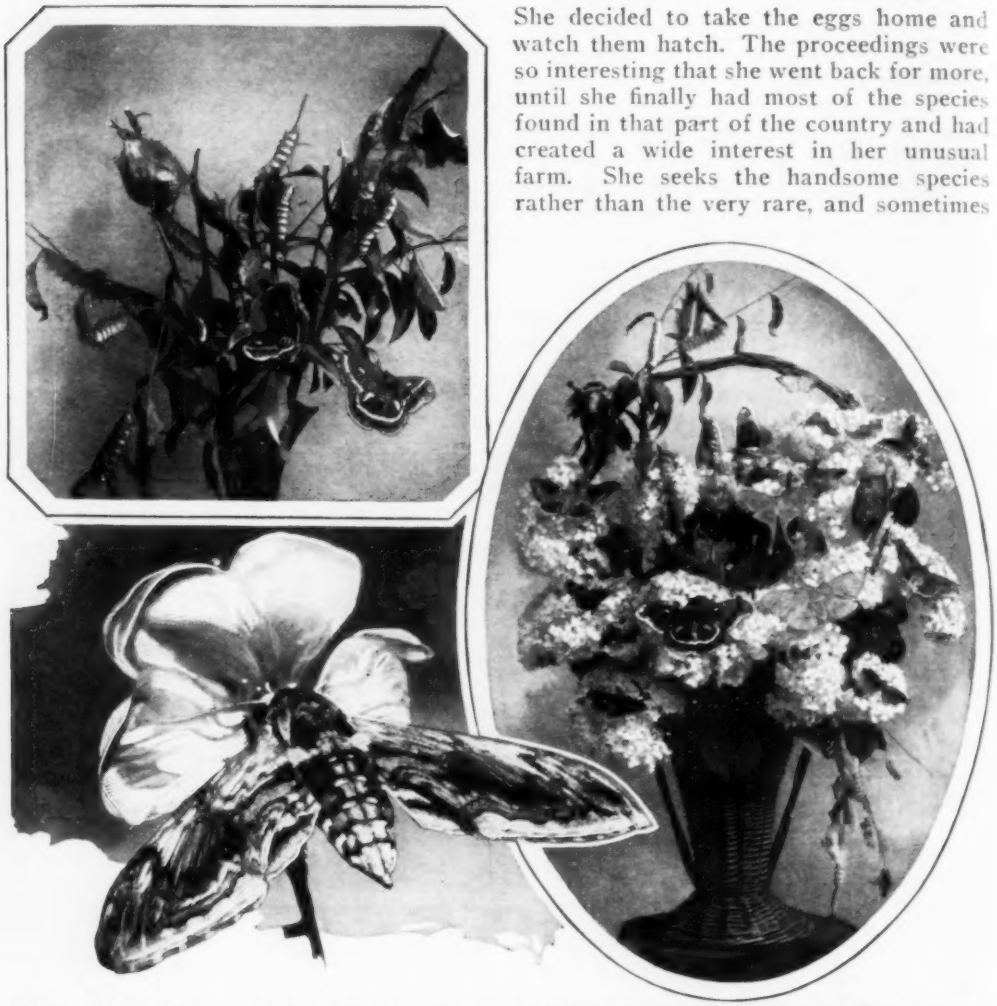
Duplicate Steering-Wheel Device Used to Measure Steering Effort, Top; and an Electrical Brake-Pedal Pressure Recorder, Center

How Much Pressure Does It Take to Operate Your Clutch? The Testing Engineers Do Not Guess, But Use This Spring Scale to Get Accurate Figures

Recently Dr. Harold Hough, prominent Detroit minister, commented upon complaints that "romance has gone from the world." A trip through any automobile-factory laboratory, said the minister, would destroy this idea. It would prove, he said, that the discovery of America was but an afternoon's incident when compared with the discoveries being made daily in the field of science.

"The more we learn about steel here, the more we realize what wonderful things are being found out," said Mr. Danse.

BUTTERFLY FARM BRINGS PROFIT AND PLEASURE



Some of the Butterflies and Moths Iowa Woman Cultivates on Her "Farm," Which Was Started as a Hobby and Has Developed into a Paying Enterprise; Specimens Are Mounted and Sold to Schools

Several hundred dollars in spare-time profits and the pleasure of pioneering in a little explored field are among the rewards enjoyed by an Iowa woman from her butterfly "farm." She hatches hundreds of the insects in a screened porch each year and mounts them for tray and table decorations while many schools of the state rely on her for supplies of butterflies and larvæ to be used in laboratory study. The venture was started as the result of the chance discovery of a cluster of butterfly eggs on the bark of a tree while she was walking through the woods. She decided to take the eggs home and watch them hatch. The proceedings were so interesting that she went back for more, until she finally had most of the species found in that part of the country and had created a wide interest in her unusual farm. She seeks the handsome species rather than the very rare, and sometimes includes dragon flies in the collection because of their brilliant and beautifully marked wings. When specimens are ready for mounting, they are painlessly put to sleep in jars filled with cyanide gas. The wings are than pressed and mounted. Backgrounds of weeds and leaves with sprinklings of "diamond dust" have proved effective for use on the tray and table decorations. The collection now numbers some 400 species and is easily maintained as leaves furnish the chief food. While raising the butterflies for sale, interesting facts have been discovered about them

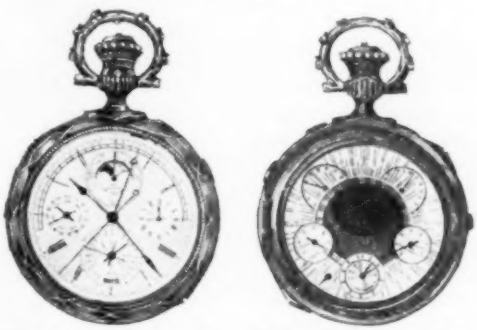
and other insects, and the hobby has taken the collector into the outdoors, an activity recommended by her physician. She has found that bright-colored flowers are the most attractive to butterflies and moths.

HORIZONTAL WELL SAVES CITY EXPENSE IN WATER SUPPLY

By means of a horizontal well instead of several vertical ones, the city of St. Joseph, Mich., has saved itself many thousands of dollars in connection with its water supply. The well was constructed by driving sheet-steel piling through the sand, fourteen feet below the level of the lake, in parallel rows, fifteen feet apart and 150 feet long. The sand between the steel was excavated, forming a long trench, which was bedded with crushed rock, and a perforated pipe, twenty-four inches in diameter, was laid at the bottom between manholes built at each end of the trench. This pipe, in turn, was packed with layers of crushed rock, and the trench filled. As water seeped in from the lake, it was filtered and drawn up for use through pumps. The supply is proving adequate for this city of 8,000 population, and the intakes are unclogged in winter.

ODD FOODS IN MANY LANDS

Crocodile meat is considered a good food by natives of Africa and southern negroes relish the tails of alligators. In the West Indies, fish eyes are regarded as a delicacy. Jellyfish are eaten in Japan and, in many places of the world, squid and octopus are valued for food. In Polynesia, a sea worm, the "palolo," which averages about sixteen inches when fully grown, is caught and prepared into an appetizing stew. Sentiment is against snakes, but they are eaten in some places and travelers testify that they are often very tasty. Hawks, herons and parrots are commonly killed for food in parts of the tropics.



Weather Prophet, Watch and Compass, All in One; the Instrument Has 292 Parts

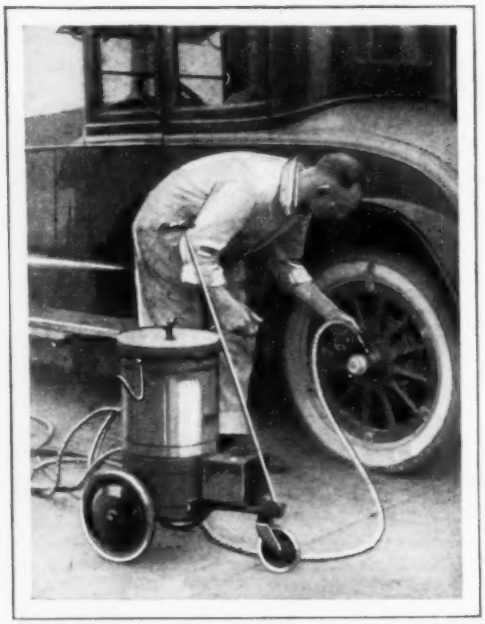
For Hot Meals on the Dining Cars; Platter with Bowl in Base, to Hold Warm Water

HEATING PLANTS IN PLATTERS KEEP FOOD WARM

For its dining-car service, a western railroad is using platters with a metal bowl in the base, which is filled with hot water to keep the food warm. A stopper keeps the contents from spilling. The same principle is applied to butter dishes, with cold water or ice to prevent the butter from melting on warm days.

WATCH TELLING WORLD TIME ALSO PREDICTS WEATHER

Constructed of 292 parts, a watch designed by a French craftsman is a small observatory in itself, for besides telling the time for the principal cities of the world, it has a thermometer and barometer, a compass, gives the signs of the zodiac and strikes the hours and quarter hours. With it, an observer can tell the day of the week, month, year, decade, the quarter of the moon and the time when the sun will rise and set for any day of the year.



Greasing the Car with the Gun; Compressed Air from the Tank Forces Lubricant into Parts

CARS ARE GREASED BY AIR GUN AT TOUCH OF BUTTON

Press a button, and grease is forced from a portable receptacle into stubborn shackle bolts, bearings and other parts of an automobile in an instant and at a saving of unpleasant work. The "gun" is operated from an ordinary air tank, such as is used for inflating tires, and is equipped with a "booster" unit, inside which the pressure may be raised as high as 10,000 pounds if desired. This is employed only when the gun is to be used. The outfit is moved about easily on a three-wheeled carriage, holds fifty pounds of lubricant and is readily refilled.

RADIO BEACON TO GUIDE PLANES THROUGH STORM AND FOG

Directing airplanes by means of radio signals has been successfully accomplished for some time and now wireless is adapted still further to the service of the airman in a beacon devised by C. Francis Jenkins, of Washington. Under his plan, planes would fly safely through a "radio channel" regardless of storms or fogs, for a little lamp, lighted by energy from a series of radio stations along the way, would burn brightly on the instrument board as long as the pilot kept to his course, but would begin to grow dim if the ship went astray. The transmitting units, Mr. Jenkins declares, could be erected at the same points where there are now lights to direct flyers, and the lamp towers already installed could be used to support antennæ of a vertical type, which would send out short waves and be placed about twenty-five miles apart. Each unit would cost not more than $250, it is estimated, and could be attended by the same men that operate the present beacons. The system would serve many planes at the same time, the inventor points out, and would operate when fogs and storms obscured the lights.

SPECTACLES FOR RACE HORSES RELIEVE VISION ILLS

Race horses have been known to stumble at a crucial moment, losing their chance of victory and seriously impairing their value. It has been discovered that this tendency is not always due to faulty feet but to defective vision. Recently, a well-known owner of "blue bloods" had a special pair of glasses made to fit a two-year old, afflicted with imperfect eyesight. The lenses were incased in a wide, comfortably fitting holder kept snugly in place with straps and bands. Marked improvement in the horse's performance was noted while wearing the glasses.

Spectacles and Goggles Combined to Aid Vision of a Valuable Race Horse and Keep It from Stumbling

How to Prevent "MOTORBOATING"

by I. F. Jackowski

WITHIN the past year the term "motorboating" has frequently been heard in connection with B-eliminators and resistance-coupled radio circuits. The term was used because it clearly defines the put-putting sound heard in the speaker, which under aggravated conditions seriously interferes with the program. A careful check of the set is required to eliminate this noise, but when the cause is understood, it is a simple matter. Blocking, distortion, whistles and other similar troubles are often symptoms that derive from the same cause.

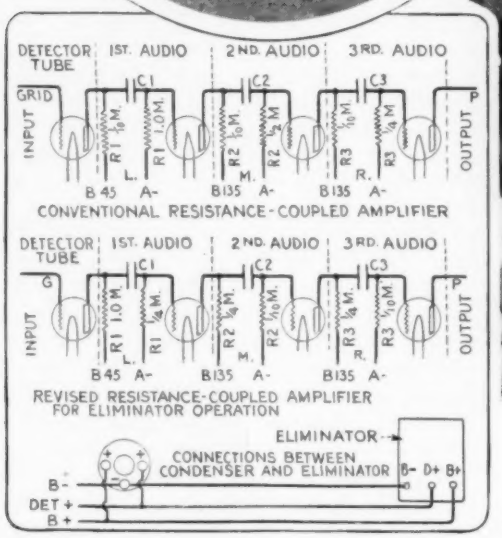
One of the most common causes will be found in B-batteries that have fallen below the necessary potential for producing good results. Such batteries are tested in the manner shown in the upper photo on page 827. A d.c. voltmeter, reading to 50 volts, is used, and if the average voltage has dropped, say, to 18 volts in a 22½-volt block, it should be discarded. In a 45-volt block, a drop to 38 volts will often cause trouble, and the remedy is a new unit. It is always best to renew all units as the new cells will quickly drop to the level of the older ones when connected in series. As the voltage decreases, the internal resistance of the battery increases, resulting in a common high impedance, or resistance caused by reactance. High resistance at any point in the installation means poor output voltage. New B-batteries of good quality have a low internal resistance and maintain, in most cases, a constant voltage. The situation is somewhat different in most B-eliminators, because the output voltage decreases as the current flow increases. In the correctly designed eliminator, a surplus of power is provided so that in actual operation the plate or B-potential will be correct at all times.

Study the needs of your set and be sure that the correct B-voltage is applied to the terminals, as designated by the designer of the set. The ordinary d.c. voltmeter, even though designed to cover the maximum B-voltage, is not suitable for checking B-eliminators. A true reading will not be obtained unless the voltmeter is of the high-resistance type, of 1,000 ohms per volt, and a maximum voltage range. Such instruments are now available in a small table type, shown in the headpiece. The eliminator may be tested under operating conditions and will give an accurate reading. It is then a simple matter to adjust the control knobs on the eliminator to obtain the required voltage at the terminals. The average five-tube radio set consumes 40 milliamp. of plate current; the drain of plate current on the B-supply depends on conditions in the set and is increasingly proportioned through each tube, the greatest change

taking place in the last audio tube. When the set is connected to the B-supply, it constitutes a resistance, which changes with the modulation of the received signals, the B-voltage unit passing current accordingly. This variation in the signal strength will produce a rapid charge and discharge of the condensers in the filter circuit of the B-supply, which, if effected by high-resistance conditions, is unable to respond to the changes. The fault may lie either in the set or in the eliminator, and the remedy is applied to either or both of the units.

A capacity of about 30 mfd., shunted across the output of the B-eliminator, a low-resistance rectifier and choke coils properly applied remedy this trouble. The average experimenter will find this rather hard to do, but much of the trouble in the unit is now overcome, owing to improvements in eliminators, and the large condenser shunted across the output, as shown in the diagram on this page, will correct the average deficiency in this respect. Condensers of this type are now available and very easy to install.

A very common cause of motorboating is an imperfectly designed or defective resistance-coupled audio-amplifier unit in the set. Those who are contemplating using an amplifier of this type with a B-eliminator for the first time, will very likely be introduced to the effects of motorboating, unless the instrument has been designed especially to prevent this. The cause lies in certain reactions that take place within the unit from improper values of resistance, although the unit may work well with the ordinary dry B-batteries. The usual resistance-coupled unit designed for battery operation will employ a resistance of 100,000 ohms (.1 meg.) in the plate circuit of the detector tube, as pointed out in the photo on page 827; this is satisfactory for dry B-



In Circle, Discharging Fixed Condenser; Above, Charging Condenser

batteries but the B-eliminator will supply an excess of voltage to the plate of this tube and, unless a resistor of higher value is used, the result will be motorboating. Resistance-coupled amplification is far more sensitive to low frequencies than to higher frequencies; therefore, the residual hum of the alternating current is amplified, and this, when added to the modulated signals, aggravates distortion, and motorboating occurs. The upper diagram

on page 826 shows the usual standard resistor combination, and the one below a combination that engineers have worked out especially for use with B-eliminators.

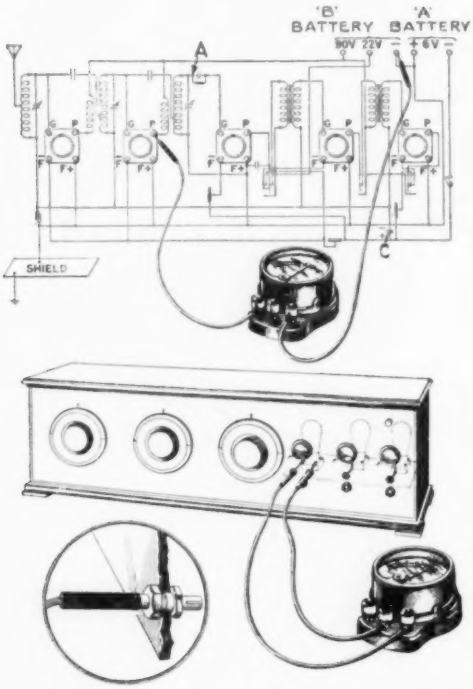
To further filter the noises referred to as caused by the a.c. current, the electrolytic condenser of 30 mfd., or one of similar type, across the eliminator output may or may not be required, depending on the efficiency of the eliminator as a full-wave rectifier. Defective blocking condensers in the amplifier until will cause serious trouble. To check such fixed condensers, remove them from the unit, if possible, and check them with a pair of phones in series with a battery. An accurate check is obtained by discharging the

Above, Testing 45-Volt B-Battery Unit; Left, Pointing Out Resistor in Plate Circuit of Detector Tube

condenser of any residual charge it may contain. This is done by placing a knife blade, or other metallic instrument, across the terminals, as shown in the insert on page 826. When tested, there may still be a faint click in the phones on first contact. If so, remove the contact and again apply it; if no click is heard, the condenser may be considered efficient or at least to contain no short circuit.

The ability of a condenser of this type to hold its charge may be determined by charging it as shown in the lower photo on the same page and setting it aside for a minute or two before testing. The strength of the click at the end of this period will determine the strength of the charge retained. If defective, the condenser will quickly lose its charge through leakage, due, perhaps, to defective workmanship or poor insulation. When replacing a condenser, be sure that the new instrument is of the same rated value and of good quality. If a highly regenerative set is used in connection with a resistance-coupled amplifier, several complications often occur even with the best of B-eliminators. The variations in the a.c. line voltage must be compensated for, so that, when the set is tuned just below the point of self-oscillation at normal B-voltage, a slight fluctuation in the line

will not throw the set into oscillation, with resultant motorboating. A new ballast tube has been designed for this purpose,



Suggested Tests Obtained with Dual-Range Voltmeter

a constant-current device that will take care of line fluctuations. Directions for installing this tube will be found on a sheet that comes with the tube. This tube is known as the UV-876 or C-376, and is placed in series with the primary of the transformer supplying the eliminator.

Now that we have covered the most common cause and remedy for motorboating, still further check can be made in the set to locate other possible sources of trouble. Here again a voltmeter of the d.c. dual-range type or a dual-range B-eliminator voltmeter may be used for measurements within the range of the instrument. Circuit-continuity tests are familiar to most experimenters, and the procedure is outlined in the diagram on this page. In general, it is only necessary to test from the batteries to the four binding posts on each tube base in the following manner: Connect the voltmeter for the low-range reading to test the filament circuit to each tube and see that the reading is as specfied by the tube manufacturer. The negative connection from the voltmeter is, of course, connected to the negative terminal of the A-battery, and the positive connection moved from one positive terminal to the other on each tube socket. The rheostat controlling each tube is adjusted to the best operating voltage which, in the case of a 201-A tube rated at 5 volts, may be as low as 4 or 4½ volts; the main advantage being to see that excessive voltage harmful to the tube is not applied. A permanent installation of midget jacks, mounted on the front panel as shown below the diagram, may be used, greatly simplifying these tests.

To test the grid-circuit wiring of the detector tube, use the same connectors and touch the wiring at the point marked A in the diagram. In the case of the neutrodyne circuit shown, this will check both the detector-grid circuit and the secondary of the second r.f. transformer. To test the wiring, main switch, rheostats and jacks between the negative side of the A-battery and the F-negative posts of the filaments, connect the positive side of the A-battery to the low-range post on the voltmeter and, with the negative terminal of the other cable connected to the negative post on the instrument, touch the negative F-post on each tube successively. To test the wiring between the positive side of the B-battery and the plate, the primary windings of all transformers and all jacks, connect the negative side of the B-battery to the negative post on the voltmeter and, with the terminal of the cable connected to the high-range post on the instrument, touch the posts marked P on each tube socket successively. This connection is shown in the upper diagram. To test the wiring between the C-battery and the grids, and the secondary sides of the transformers, excepting the grid circuit of the detector tube and the secondary of the second r.f. transformer, connect the positive post on the C-battery to the low-range post on the voltmeter and, with the other cable from the negative post on the voltmeter, touch the G-post on each socket successively. This makes a complete test for continuity for this particular type of circuit, and it is a simple matter to adapt it to any set you have.

Any deflection of the voltmeter pointer

indicates that the circuit is continuous to that particular point. If no deflection is obtained, which is the indication of a fault, it is necessary to go back on this circuit toward the battery, touching the various points until a deflection takes place. The faulty part is then readily found. For some types of circuits, it is advisable to test the transformers separately; in this case, connect a 6-volt storage battery or several dry cells in series with the voltmeter and the transformer winding. The continuity tests give you a true idea of what is going on in the set and further demonstrates the value of a good dual-range voltmeter.

Shielding A. C. Line to Prevent Hum

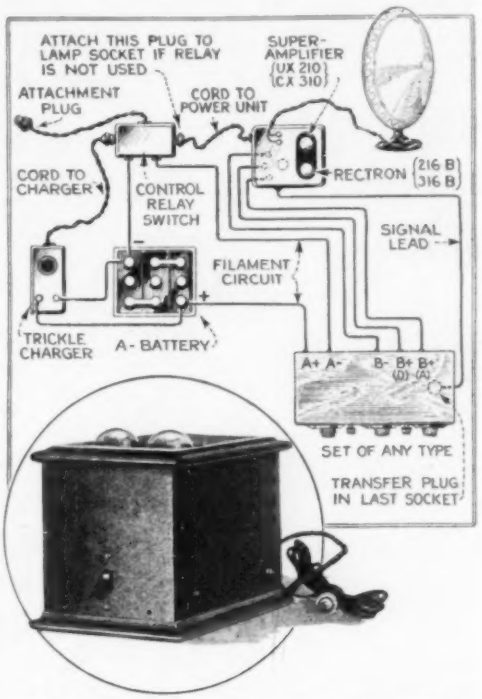
Alternating-current hum caused by socket leads may be eliminated by shielding the lead with tinfoil. Cut the foil in strips, and wrap it around the wire, also wrapping bare copper wire over the foil and grounding one end to a water pipe.

Tester for Service Men Is Portable

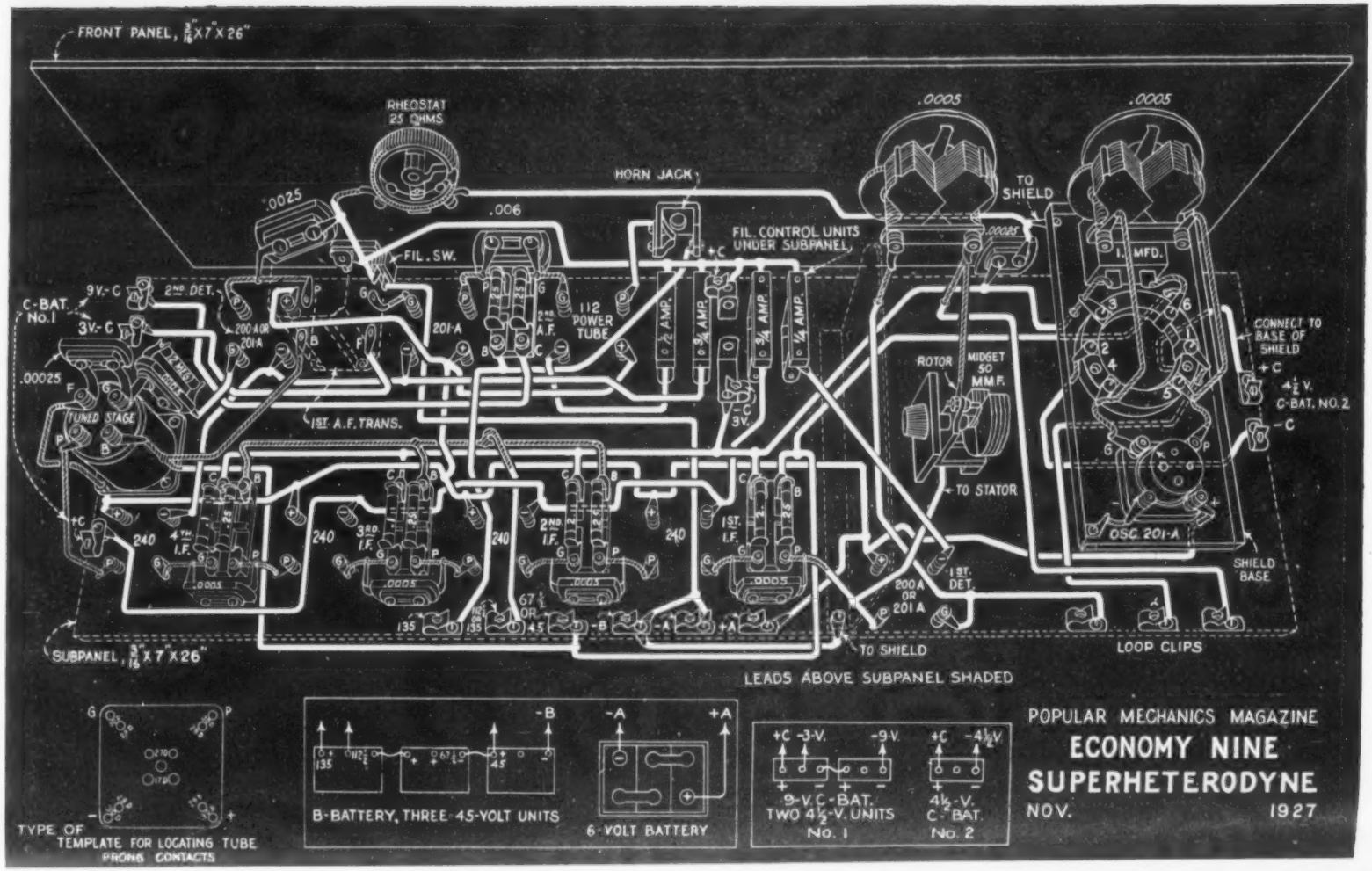
This tester is useful for radio-service men and experimenters who go deeply into the subject of checking their work in order to obtain maximum results at all times. For measuring the various voltages in either a battery or a battery-eliminator operated set, both at the battery terminals and at the tube sockets, and for testing tubes under operating conditions this tester is ideal. Tests may also be made for continuity and condition of circuits, all of them being made with the regular batteries or battery eliminator used in the radio set without change in connections. The voltage ranges have a sensitivity of 1,000 ohms per volt, which means that full-scale deflection is produced with a current of only 1 milliamp.

Power Amplifier and B-Eliminator Combined in One Unit

Combining all the good points of the latest type of power amplifier with an efficient B-eliminator, this compact device may be used with any radio receiver. The wiring diagram shows the power unit replacing the usual B-batteries and, in addition, supplying the necessary high voltage for the power-amplifier tube. The loud speaker is removed from the set and plugged in at the power-amplifier outfit. An automatic relay switch, trickle charger and storage battery complete the installation, forming a complete power plant. The plug from the relay switch is connected into the 110-volt house-lighting line and the power supply is controlled from the switch on the front panel of the set. This simple method of bringing the old receiver up to date or making a new one better, without complicating the wiring, fills a long-felt need. The signal lead from the power unit is plugged into the last audio socket, and the full benefit of the 210 super-amplifier tube is thus obtained.


ATTACH THIS PLUG TO LAMP SOCKET IF RELAY IS NOT USED
SUPER-AMPLIFIER (UX 210) (CX 310)
ATTACHMENT PLUG
CORD TO POWER UNIT
CORD TO CHARGER
CONTROL RELAY SWITCH
RECTRON (216 B) (316 B)
SIGNAL LEAD
FILAMENT CIRCUIT
TRICKLE CHARGER
A- BATTERY
A+ A- B- B+ B+ (D) (A)
SET OF ANY TYPE
TRANSFER PLUG IN LAST SOCKET

Amplifier and Diagram of Connections for Power Amplification and B-Elimination


FRONT PANEL, 3/16 X 7" X 26"
RHEOSTAT 25 OHMS
.0025
.006
HORN JACK
FIL. SW.
FIL. CONTROL UNITS UNDER SUBPANEL
.0005
.0005
TO SHIELD
1 MFD.
C-BAT. NO. 1
9V.-C
3V.-C
2ND DET.
200A OR 201A
201-A
2ND A.F.
112 POWER TUBE
½ AMP.
¾ AMP.
¾ AMP.
¼ AMP.
CONNECT TO BASE OF SHIELD
+C
4½ V. C-BAT. NO. 2
-C
.00025
TUNED STAGE
1ST A.F. TRANS.
ROTOR
MIDGET 50 M.M.F.
TO STATOR
OSC. 201-A
4TH I.F.
3RD I.F.
2ND I.F.
1ST I.F.
240
.0005
1ST DET.
200A OR 201A
SHIELD BASE
67½ OR 45
135
-B
-A
+A
SUBPANEL, 3/16 X 7 X 26"
TO SHIELD
LOOP CLIPS
LEADS ABOVE SUBPANEL SHADED
G
P
TYPE OF TEMPLATE FOR LOCATING TUBE PRONG CONTACTS
B-BATTERY, THREE 45-VOLT UNITS
6-VOLT BATTERY
+C -3-V. -9-V.
9-V. C-BAT. TWO 4½-V. UNITS No. 1
+C -4½V
4½-V. C-BAT. No. 2
POPULAR MECHANICS MAGAZINE
ECONOMY NINE SUPERHETERODYNE
NOV. 1927

SIXTY DOLLARS builds Nine-Tube SUPERHET

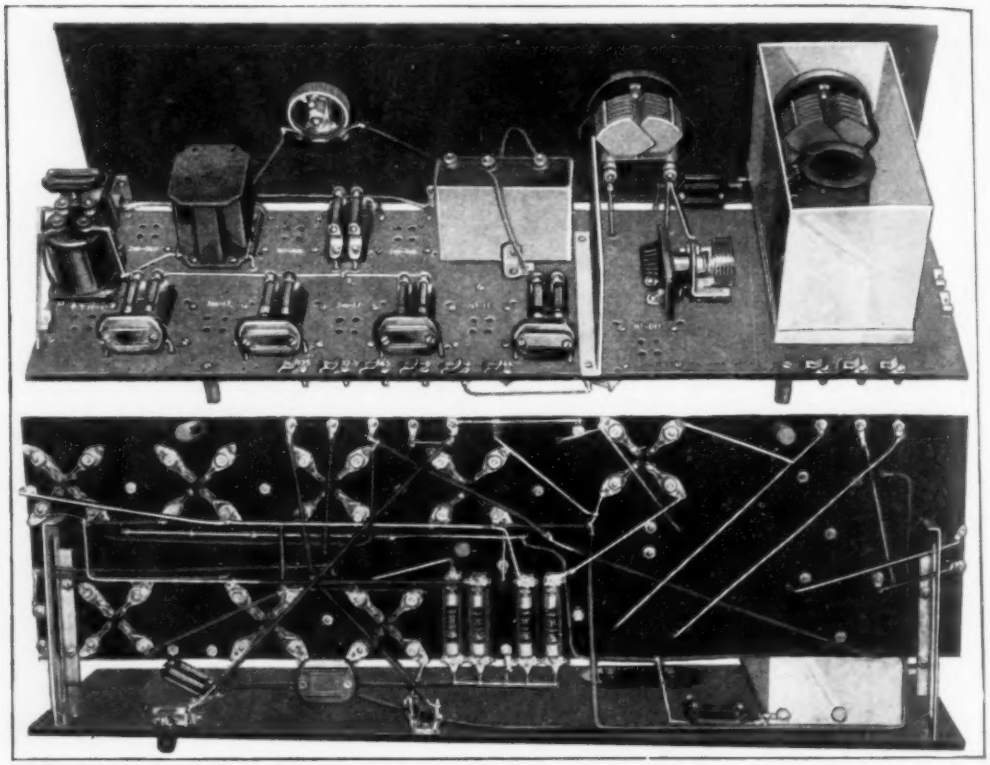
by FRANK L. BRITTIN

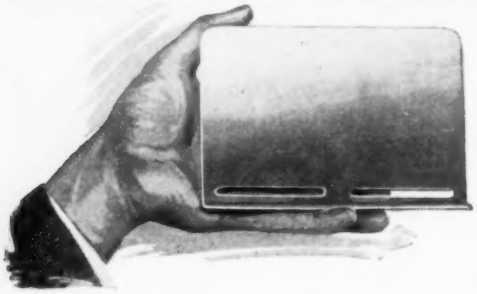
DECLARED by experts to equal, if not excel, the finest superheterodynes hitherto available, the latest development of Popular Mechanics radio laboratory fills a long-felt want. Not a single thing has been sacrificed for efficiency; in fact, through simplicity of construction and the elimination of nonessentials much has been gained, and, best of all, this set really costs less than many four and five-tube sets, as $60 completely covers the cost of all materials, except tubes and batteries. Tests covering a period of six months have been highly satisfactory and no set that we have seen has better tone, selectivity and range.

The circuit is similar to our previous models, but several improvements have been made in the oscillator and intermediate-frequency amplifier. The controls on the front panel have been reduced to three, and the operation is so simple that the set can be tuned by a child. The circuit consists of an oscillator, first detector, four stages of resistance-coupled intermediate-frequency amplification, second detector, one stage of transformer-coupled audio and a second audio stage of the resistance-coupled type. Due to the complete shielding, the howls usually associated with supers are absent, and selectivity is increased to a point where near-by powerful stations may be separated by a one or two-degree movement of the dials. One standard socket is used for the oscillator tube, but all other sockets are built up directly on the subpanel. No effort has been made to use cheap material; all parts specified are of the highest grade and in this lies much of the succcess of the new receiver.

The intermediate stages are built up across the subpanel in individual units; resistors and condensers of highest efficiency and the new 240, 30-MU tubes are employed. These are specially designed for use in resistance-coupled sets, and, since the amplification in resistance coupling is entirely due to the amplification constant of the tube itself, the advent of these tubes, of exceptionally high amplification factor, is of prime interest. They have the same filament characteristics as the standard 201-A type, namely, 5 volts and .25 amp. The plate voltage, on the other hand, can and should be about 135 volts; the plate-coupling resistor should be 250,000 ohms (.25 meg.) instead of the usual 100,000 ohms (.1 meg.). These tubes may also be used as detectors, if desired, in which case the plate voltage would be 67½ or 90. The 200-A type, however, is specified for this circuit.

The detailed wiring diagram given further illustrates the extreme simplicity of the set; the rear of the front panel is shown in detail and the subpanel is dotted in, giving an "X-ray view" of the wiring. The few wires that show above the subpanel are shaded and by referring to the rear-view photo these wires are easily located. Drilled and engraved panels will be available for those who do not wish to drill their own, and full-size templates and enlarged layout diagrams have been prepared, simplifying construction to such an extent that the set can be built by a





Top, Rear View of Completed Set with Lid of Oscillator Shield Removed; Center, Undersubpanel Showing Method of Wiring and Instrument Assembly There; Left, Side View of First-Detector Shield

novice. The necessary tube-prong clips, machine screws and nuts for building up the sockets on the subpanel come in sets, the manufacturer also providing a steel jig for properly locating the holes. A sketch of this jig or template, showing the various drill sizes, will be found at the lower left on the simplified wiring diagram on page 830.

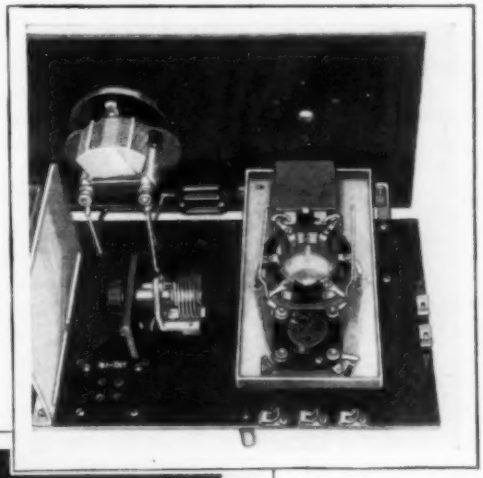
C-battery No. 1 consists of two 4½-volt units connected in series and is connected to the Fahnestock clips on the left side of the subpanel as shown; use 3 or 4½ volts for the first audio stage and 9 volts for the second. C-battery No. 2 is a single 4½-volt unit and is connected at the extreme right side of the subpanel as indicated at the right.

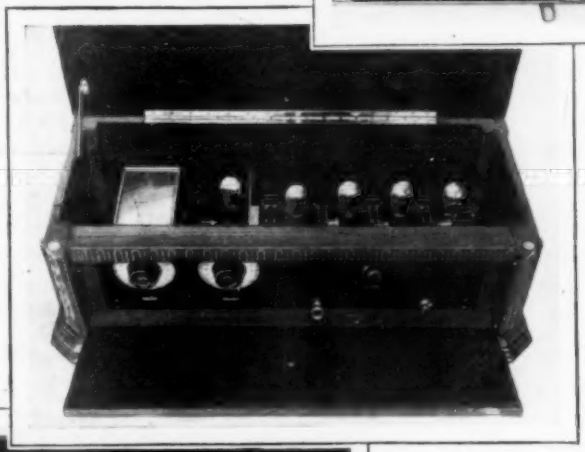
After the instruments have all been assembled on the front and subpanel, and the subpanel brackets are in position, screw the front panel to these brackets, and place long round-hole soldering lugs under each terminal that is to be connected in the circuit. Referring to the photos on this page, it should be noted that while only two wooden pins that support the rear of the subpanel are visible, there is a third one in the center. These supports are made from dowel stock, 7/16 in. in diameter and 1¼ in. long, and are held in position by oval-head nickelplated wood screws, ½ in. long. The instruments located on the underside of the subpanel are clearly shown in the lower photo; the filament-control units are grouped in the center at front. The ½-amp. type controls the filament of the power tube; the

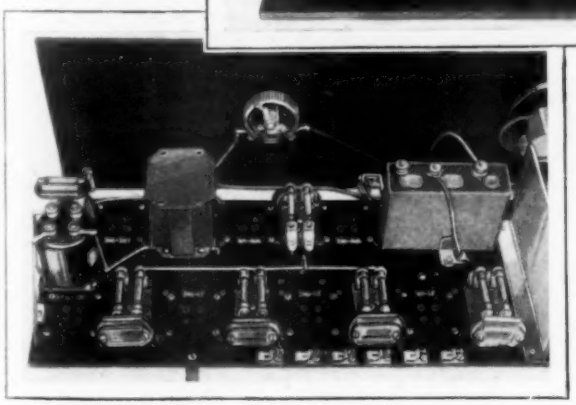
two ¼-amp. units control three tubes each, and the ¼-amp. unit, the first detector tube. The oscillator is manually controlled by the rheostat on the front panel, and the operator will soon learn that the proper handling of this rheostat in tuning gives the set unusual flexibility. The three small fixed condensers shown are the two .0025-mfd. and the .006-mfd. shown in the detailed wiring diagram. The negative lead from the rheostat is connected to a lug bolted to the bottom of the aluminum can at the front, the can itself thus becoming the negative side and automatically grounded to the common A and B-negative line. The negative lead to the filament of the oscillator tube is taken to the socket post from a lug bolted to the bottom of the can at the rear. The 1-mfd. fixed condenser, shown at the front of the can base and located directly below the oscillator condenser, is laid flat on the bottom of the can, as shown in the upper photo on this page. The tube socket, coil socket and 1-mfd. condenser are all mounted on the can base, in position on the subpanel, and soldered in the circuit before the can is placed in position. Enlarge the holes with a reamer where the leads pass through the can base, and use good black spaghetti tubing on these wires to prevent shorts.

Now remove the oscillator condenser and prepare the front side of the can for mounting. Place the open can in position on the base, and, with an icepick or other sharp instrument, mark off the positions of the various holes for the condenser at the front, through the front panel. Drill and ream out the holes so that the mounting bosses on the front of the condenser fit flat against the bakelite front panel, and see that the condenser-shaft hole is amply large to clear the shaft. With the open can in position, the condenser is now remounted, and the leads from points 4 and 5 on the coil socket soldered to the variable-condenser lugs. These leads should be bent so as to clear the coil when it is in the socket, and should clear both coil and can sides by about one-half inch.

The shield between the first de-







Upper Right, Close-Up of Oscillator-Unit Assembly on Base of Shield; Midget Condenser, Wavelength Condenser and First-Detector Socket at Left; Center, Completed Set; Bottom, I. F. and A. F.-Amplifier Section

tector and the first intermediate amplifier unit can be a standard heavy aluminum shield, or made of heavy sheet brass, 4½ by 6 in. If homemade, a ½-in. flange is turned at the bottom for mounting on the subpanel, as in the manufactured type shown in the photo. This shield is grounded to the common A and B-negative post, as shown in the diagram. The midget condenser can be mounted on a strip of bakelite by means of two small brass brackets in the manner shown. (The newer type of the condenser specified will be provided with a mounting bracket.) The tuned-stage transformer or filter shown at the extreme left is tuned to a frequency of 45 kilocycles by means of the .00025-mfd. fixed condenser shown across the secondary at F and G. A second clip on the G-post supports the combination grid condenser and gridleak for the second detector tube. Any good filter, tuning between 40 and 80 kilocycles, can be used and, because of the construction of the intermediate amplifier, no haphazard matching of intermediate stages has to be contended with, as in the transformer-coupled type.

The first a.f. amplifier consists of a good heavy-type transformer, and $6 has been allowed in the specifications for a good instrument. The better this transformer is, the better the tone of the set will be, and a few extra dollars invested here are well spent. The last audio stage is of the resistance-coupled type, the coupling condenser at this point being .006 mfd. This coupling may range from .006 to .05 mfd., but for general purposes the .006-mfd. is satisfactory. The plate-coupling resistor is 250,000 ohms (.25 meg.), and either a 100,000-ohm (.1 meg.) or 250,000-ohm (.25 meg.) resistor for the grid. In the bottom photo on page 833, note the position of the 4½-volt C-battery, only 3 volts being used for further biasing the grids of the intermediate stages. This battery is held in position by two metal brackets, fitted with Fahnestock clips for terminals, and the assembly is bolted to the subpanel with short brass machine screws. No template of the front panel or subpanel is given because of the lack of space necessary to show them in working detail, but full-size drilling templates of both panels will accompany the blueprints.

After the wiring is completed, connect the batteries to the set and place one tube in each socket successively with the filament switch turned on; if the tube lights correctly in each socket, all tubes may be plugged in. The loop, which must be of

MATERIAL LIST

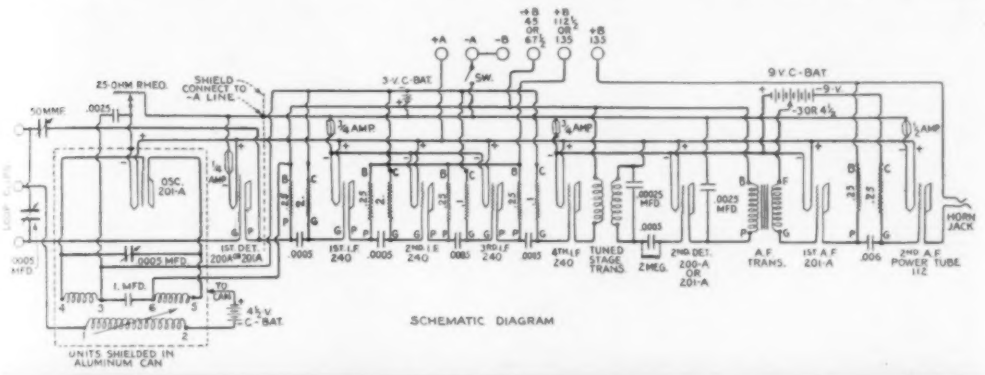
2 panels, 3-16 by 7 by 26 in.
1 pair S-M No. 540 subpanel brackets.
2 Remler condensers, No. 639, .0005 mfd.
2 Remler dials, No. 636.
1 25-ohm rheostat, Frost, Yaxley, Electrad, Carter or similar type.
1 open-circuit jack, short type, Frost, Carter, Yaxley or similar.
1 filament switch, Frost, Carter, Yaxley or similar type.
1 Hammerlund midget condenser, 50 mmf.
1 Benjamin, X-type, spring-suspended socket.
8 packages American UX prong contacts, style A.
1 American Radio Hardware Co. steel template for UX prong contacts.
1 S-M aluminum shield, type 631.
1 S-M plug-in coil, type 110-A.
1 S-M universal socket, type 515.
1 a.f. transformer, S-M No. 240 or any similar type.
1 Remler tuned-stage transformer, type 610, or filter of similar type.
5 Sangamo condensers, .0005 mfd., one with gridleak clips.
2 Sangamo condensers, .0025 mfd.
1 Sangamo condenser, .00025 mfd.
1 Sangamo condenser, .006 mfd.
1 Alcoa aluminum or brass shield, 4½ by 6 in.
1 condenser, 1 mfd., series A, Acme, Tobe or similar type.
5 double resistor mounts, Lynch, Electrad or similar type.
6 resistors, ¼ meg. (.25), Electrad, Lynch, Durham, Daven or similar type.
2 resistors, 1-10 meg. (.1), Electrad, Lynch, Durham, Daven or similar type.
1 resistor, 2 meg (2), Electrad, Lynch, Durham, Daven or similar type.
2 filament-control units, ¾ amp., Amperite, Ballast or similar type.
1 filament-control unit, ¼ amp., Amperite, Ballast or similar type.
1 filament-control unit, ½ amp., Amperite, Ballast or similar type.
16 Fahnestock clips, small single type.
10 lengths round tinned-copper busbar wire, No. 14.
4 lengths good black spaghetti tubing.
60 soldering lugs, long, round-hole type.
4 small brass angle brackets, 1-16 by ¾ by ¾ in.
3 doz. 6-32 nickelplated round-head brass machine screws, ½ in. long.
5 6-32 round-head brass machine screws, ¾ in. long.
5 6-32 round-head brass machine screws, 1 in. long.

Above material not to exceed $60 at retail prices.

SUGGESTED EQUIPMENT

4 Diatron 240, or UX-240, CX-340 (30 MU type).
3 Diatron, 200-A, or 200-A UX or CX types.
2 Diatron, or UX or CX 201-A tubes.
1 Diatron, or UX-112 power tube.
4 Burgess C-batteries, type 2370, or Eveready, type 771.
3 heavy-duty 45-volt B-batteries.
1 6-volt storage battery.
1 S-M output transformer, type 222, or similar (optional).
1 loop, three-tap box type, Quali-Tone or similar type for .0005 condenser.

...e three-tap type designed for use with a ...005-mfd. condenser, is then connected. the midget condenser to the point that gives the loudest and clearest signal. Once



Above, Schematic Diagram; Below, Close-Up of Front Panel, Showing the Simple Controls, the Horn Jack and the Filament Switch

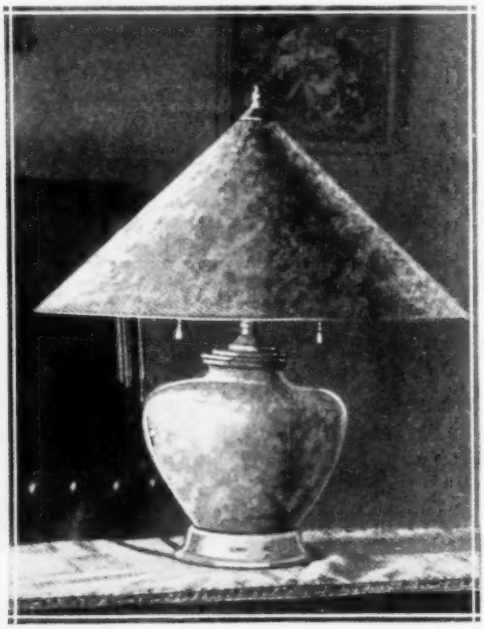
Note that the center loop clip, marked with an X in the detailed diagram, must always be connected to the center loop lead, while the two outer loop leads may be connected to either of the two outside loop clips on the subpanel. Keep the loop leads as short as possible.

To test the set, plug in the coupler coil and place the rotor of the coupler at an angle of about 45°, replacing the lid of the can firmly so that it will not vibrate. Plug in a good loud speaker and turn on the filament switch. Turn the rheostat up from one-fourth to one-half its range from the left, exact position to be found by trial. To pick up a station, slowly rotate the dials in step, never turning them independently when locating a station. When the signal is heard at good volume, leave the oscillator dial as it is, and turn the wavelength dial a few points on either side of the oscillator setting, to bring the signal in at maximum strength. This tuning must be slowly done as the set tunes very sharply, and if the dials are tuned by jerks, it is quite possible that the station will be passed over. Now adjust

found, this setting need not be changed. These first tests should be made when local stations are known to be on the air. The best B-battery combinations will be found by trial; for the first test use 45, 112½ and 135 volts on the clips, as indicated in the detailed wiring diagram. If this combination is not satisfactory, use 67½ on the clip marked 45. The use of a good output transformer between the set and the loud speaker, although optional with the builder, greatly increases the handling power of the speaker. The device is shown next to the speaker in the photo at the head of the article; it is very easily installed at any convenient point either in the cabinet or near the speaker.

Popular Mechanics radio laboratory will be glad to answer any inquiries regarding the construction of the set, and a complete set of enlarged blueprints of the simplified diagram and full-size drilling templates have been prepared. These may be obtained from Popular Mechanics Radio department, 200 E. Ontario st., Chicago, Ill., for 50 cents, which covers cost and packing. Specify blueprints No. 123.

Art Lamp and Cone Speaker Combined



Art Lamp Speaker Connected to Radio Set Is Placed on Near-By Table

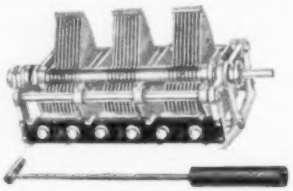
Combining a table lamp with an efficient cone speaker, this attractive and useful outfit is one of the new devices on the radio market. The loud-speaker unit is sturdy, dustproof and unaffected by weather and temperature changes. Twenty feet of silk radio cord and 8 ft. of lamp cord come as regular equipment with the speaker. The bowl is of artistic pottery, and the cone serves both as loud speaker and lamp shade.

Eliminating Unnecessary Leads

Much has been said in regard to keeping the leads in a radio receiver as short as possible, but not only can they be shortened; some of them may be entirely done away with. The following suggestions will be of interest not only to the set builder, but also to the fan who would like to simplify and improve his present set. Before making any changes in the wiring, however, it is well to make a diagram of the circuit for reference. It will be found that a wire from the ground post connects with one of the filament leads. Remove this post and lead, and connect the ground directly to the A-battery positive or negative terminal, whichever the case may be. As the batteries are usually on the floor or a shelf under the table, you are doing away with about 3 ft. of wire right here. A binding post for the B-negative connection is unnecessary. Run a lead from the B-battery negative directly to the A-battery, usually the positive terminal. Consult your diagram. For more than one reason, it is best to place the C-battery inside the cabinet. Because of its comparatively long life, it can be wired into the set permanently. Start a wire at the F-post of the first a.f. transformer, run it straight to the same post on the second transformer and then to the negative terminal of the C-battery. The positive terminal of the C-battery connects to the nearest point in the A-negative busbar, between the rheostats and the battery. Place all the batteries close together on a shelf under the set and connect them with short lengths of No. 14 rubber-and-fabric insulated wire. Long straggling pieces of small wire increase the resistance and invite short circuits.—John C. Heberger, Rochester, N. Y.

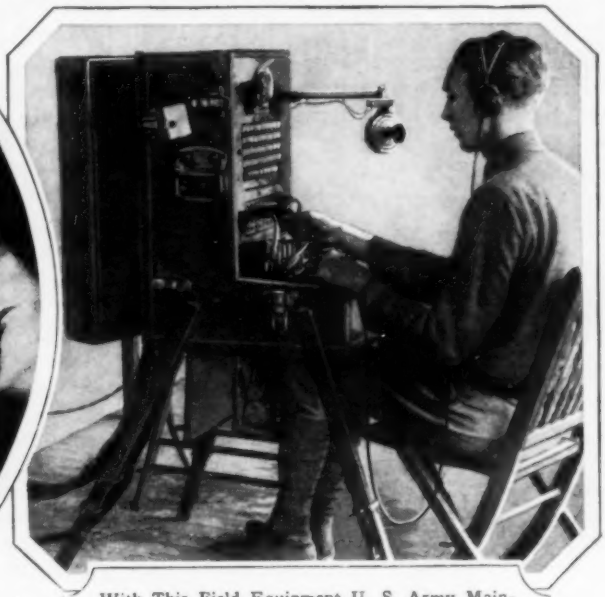
Three-Gang Condenser Is Adjustable

An adjustable three-gang condenser, making possible the balancing and tuning of any desired number of circuits with one dial, is now available. Provided with a special adjustment feature and employing a tool supplied with each unit, as shown in the photo, the condenser can be set for perfect equalization of all circuits after the receiver has been completely wired. This eliminates the necessity for using vernier or trimmer condensers. Complete instructions for making this adjustment are supplied with the unit. The shaft may be shortened or lengthened or entirely removed without affecting the adjustment of the rotor plates. The condenser is so designed that it may be mounted from either end. A variable spring tension is provided and the rotor is mounted on ball bearings.



Facts and Fads for Radio Fans

James Carrigan, Former Juvenile Star of the Movies, Invents New Loud Speaker, Employing Two or More Cylinders and a Conical Diaphragm

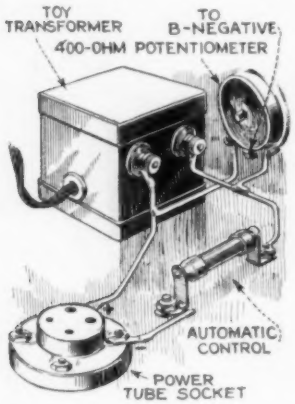


With This Field Equipment U. S. Army Maintains Radio Communication with Moving Units and Headquarters; the Signal Corps Switchboard Installation Shown Here Was Used during Recent Combined Air-Ground Maneuvers

Above, Clinton B. Hanna and Dr. Joseph Slepian with Their New Horn Designed on Mathematically Correct Enlargement of the Tone Chamber; in Tests, It Is Said to Have Broadcast Voice and Music Three-Quarters of a Mile without Distortion; Right, the Radio Receiver Attached to the Telephone Is the Invention of George F. Mitchell, of Washington, D. C.; the Telephone Receiver Serves as an Earphone, and the Instrument Does Not Interfere with the Use of the Phone

Light-Socket Supply for Power Tubes

Light-socket supply for power tubes is not a new idea, but very few simple devices have been shown to obtain the result. As all radio experimenters know, the filament requirements of any power tube are such that there are few sources of low-voltage current that are not seriously depleted when the operation of these tubes is continued over many hours. A simple method of employing the house-lighting current is shown in the sketch; a small a.c.-current transformer of the type used for operating toy trains is required. These transformers are inexpensive, and are usually tapped from six to ten volts; this voltage does not always remain constant due to line fluctuations, so some method must be used to keep the filament supply steady. This is easily done with one of the standard automatic filament-control units now in common use. These control units have the unique property of automatically changing in resistance as the filament supply changes, keeping the filament at the proper temperature at all times. The 400-ohm potentiometer across the transformer output tends to further stabilize the device and should be connected as shown and mounted on the front panel at any convenient point.—L. H. Georger, Buffalo, N. Y.



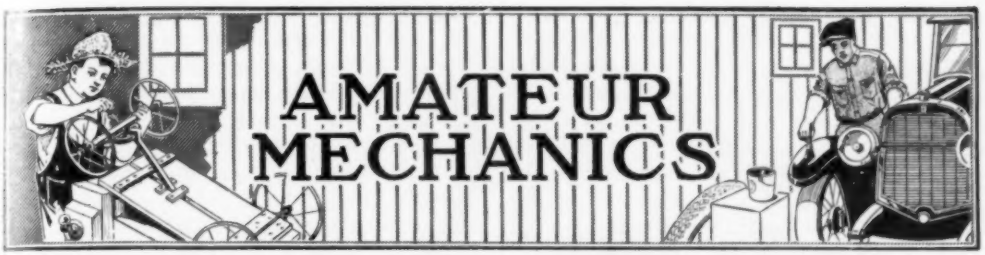
Friction of Air Layers Cause of Static

Anyone who owns a radio set is more or less familiar with the troublesome disturbance known as static. The cause of this frying, rumbling or crashing noise, frequently encountered during the summer months, is not generally understood. Often these noises are attributed to the set when it is in no way responsible for the trouble. Static and fading phenomena have been carefully studied and many interesting data obtained without materially helping the situation. It is, however, an accepted fact that the combination of temperature and barometric pressure occurring most frequently in summer is the cause of static.

Comparatively quiet air heated in varying degrees rises and mixes with the cold air above. This warm, moisture-carrying air, mixing with the cold air in the higher altitudes, causes the moisture to condense into clouds, and the friction between the moving air layers produces electrical energy. This energy, having no definite character such as radio waves, travels in all directions and cannot be controlled by human means, entering the receiving set at will. Interfering with the radio waves sent out by the broadcasting station, these outlaw waves cause the disturbance known as static. The same conditions in the upper atmosphere, in a more intense form, cause the severe electrical storms where the disturbing element appears in the form of lightning discharges.

Speaker Combined with Art Tapestry

A modern loud speaker combined with an artistic piece of neatly framed tapestry, has made its appearance among the new speakers offered for the coming season. Fine wiring, run along the picture molding to the set, which may be placed in another room if desired makes an installation puzzling to the uninitiated. As the speaker looks entirely unlike the usual type, the visitor is at a loss to account for the exact location of the sound, which comes out at the top of the speaker, travels to the ceiling and rebounds, with even volume, to all parts of the room.



Easy Way of Handling Outboard Motors

By JOHN EDWIN HOAG

WITH the increasing popularity of the large and powerful types of outboard motors, which are supplanting the smaller lightweight ones, the problem of handling the former is beginning to receive more attention from boating enthusiasts. Anyone who has ever attempted to carry one of these motors and fit it on the stern of a boat knows what a difficult task it is, for twin-cylinder motors weigh from 90 to 110 lb.

The trouble of doing this has been eliminated almost entirely by one outboard-motor enthusiast. At his recreation camp on a beautiful bay on the island of Oahu, he has a small wharf to which the boats are moored. This permits carrying the outboard motor on an ordinary baggage truck, as shown in the illustration. The truck is fitted with a wooden support, attached with the aid of lengths of strap iron. The clamps of the motor are slipped over this support, and are then tightened to prevent the motor from slipping off. It is an easy matter to push the truck to the end of the wharf.

The work of lowering the motor from the wharf into the boat and fastening it to the stern, is accomplished by means of the small hoist shown in the photo. It con-

Left, Ordinary Baggage Truck Fitted with Wooden Support Facilitates Carrying Outboard Motor; Right, the Small Hoist Eliminates the Hard Task of Lifting the Motor from Boat to Wharf or Vice Versa

sists of an old ship's davit rigged with block and tackle. This permits the work to be done with ease and speed, one person handling the tackle and another, in the boat, placing the motor in position. Pulling the motor up from the boat is done just as easily and can be accomplished with a minimum of muscular exertion. Anyone can provide these simple means of handling an outboard motor, and the cost of the material is very small, amounting to about $10 in the above case.

Substitute for Corkscrew

Two pocketknives make a very effective substitute for a corkscrew. Insert one blade between the glass and cork on one side of the bottle neck, and the other blade on the side directly opposite, with the cutting edges pointing in a clockwise direction. Place the index finger between the handles of the knives, and, pressing the thumb and middle finger against the handles, pull upward with a gradual turn, or pull down on the bottle, turning the knives around in the direction indicated by the arrows.—J. A. Langreich, Brooklyn, N. Y.

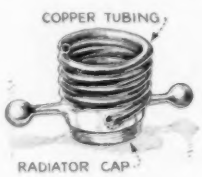
Decorating Iron Castings

Gray-iron castings for doorstops, candlesticks, bookends, andirons, door knockers, and other articles, can be obtained, and anyone can decorate them to his own taste. A coat of flat, white paint is first applied to the casting. When this is thoroughly dry, the color decoration is applied with an even stroke (the long way of the work, not across). A great assortment of paints is unnecessary, as with a tube each of red, blue, yellow, black and white oil colors it is possible to obtain any intermediate tint. For example, a mixture of red and blue produces purple; yellow and blue make green; red and yellow make orange. Shading adds greatly to the beauty of the work. When a yellow flower is painted, shade the spaces between the petals with darker yellow. High lights or prominent surfaces should be kept light, while recesses and low places should be dark. The antique finish, which adds to the beauty of the work is produced as follows: A small can or tube of Van Dyke brown, ground in japan, is obtained, and a small quantity is thinned out to make a watery mixture, using turpentine as a solvent. After the colors have been thoroughly dried and hardened, cover the entire surface with this brown paint, and immediately wipe off with a cheesecloth or a piece of rag, leaving the brown in the recesses. Bronze powders may be applied in one of the two following ways:

The commoner way is to mix the bronzing liquid with the bronze powder and apply with a camel's-hair brush, just like paint. Another method consists in coating the work with flat varnish and, when this has become almost dry or tacky, dusting on the bronze powder with a rather heavy camel's-hair brush. The different designs on the same piece may carry a separate shade of bronze, as bronze powders are made in a variety of colors. If a brilliant, highly polished surface is desired, use enamel or lacquer paints. The low parts, and those farthest away from you, should be painted first, and the color is then applied to the highest points of the design. A coat of flat varnish or white shellac, applied after the painting has been completed, will preserve the finish.—J. S. Hagans, Chicago.

Reflux Condenser for Auto Radiator

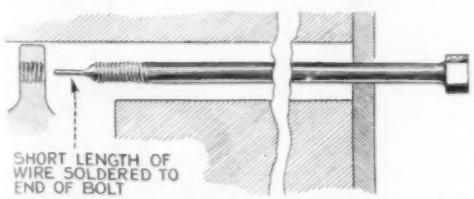
The alcohol in radiators may be saved from evaporation by soldering a reflux condenser on the cap, as shown in the illustration. The overflow pipe is closed with a wooden plug, so that all the vapor must pass through the coiled tube on the cap. When the vapor strikes the cool tube it condenses and flows back into the radiator. This suggestion comes from the cold woods of



Maine where the thermometer has reached 20 below zero. The radiator on which this condenser is used is protected by only 1 gal. of alcohol, and, although the machine stands outside at all times, the water has not frozen in the radiator, proving that the loss by evaporation is very slight. Anyone can make this device. It consists of 2 ft. of ¼-in. copper tubing, wound around a bottle or similar cylindrical object, so as to get a smooth, even coil. A hole to fit the tube is drilled in the cap, and the tube is soldered to it, inside and outside. Radiator caps equipped with a motometer can also use the device, by placing the coil in front of the meter. In this case a better job can be done if ⅛-in. tubing is used and a smaller coil is wound.—Edward Engel, Orono, Maine.

Assembling Bolt in Door Lock

When assembling a flush extension bolt on a double door, I found that it was rather difficult to discover the tapped hole into which the end of the bolt was screwed. The trouble was readly overcome by soldering a short length of wire to the end of the bolt, as



Finding the Tapped Hole for a Long Bolt in a Door Lock

shown in the illuustration. The extension served as a feeler and enabled me to find the hole quickly. When this method is used, care must, of course, be taken not to get solder between the threads of the bolt.—Rivers Peterson, Indianapolis, Ind.

¶When a candle does not fit in a holder, the end is usually scraped down. A better method is to hold the end in hot water until it becomes soft. Then it can be forced into the holder without difficulty.

Tubes with Rubber Nipples Leading to Pails Solved Feeding Problem for Young Pigs

Feeder for Young Pigs

The accompanying drawing illustrates a contrivance that can readily be made by pig breeders for the feeding of young pigs that have lost their mothers. It is quite a simple, yet perfectly satisfactory, arrangement. At intervals along a wide board are fixed plugs with rubber nipples attached. Tubes lead from the nipples into pails of milk against which the board is propped. The pigs take to this device at once.—Thos. Goudie, Rangoon, Burma.

Drilling Level Holes with Brace and Bit

There are often occasions when one is called upon to drill holes horizontally, but to get them perfectly level is usually quite difficult. However, here is a simple hint which will aid the worker to get them as straight as is required. Before placing the bit in the brace, place a metal washer on the shank of the bit. This will plainly show how the brace is being held and, with repeated practice, will in time develop a better eye for the work.

Masked Costume Made from Cardboard Boxes of Various Shapes and Sizes

Novel Costume Made from Corrugated Fiberboard Boxes

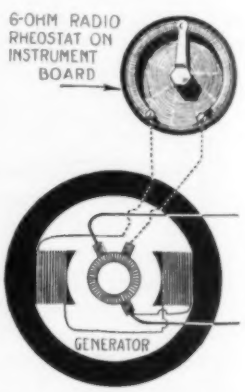
Corrugated fiber boxes of various sizes and shapes make up the disguise shown in the photo, a costume which recently won first prize at a masked party. The legs are sections of a box originally used to ship the handle of a vacuum cleaner. Two corners of each of these sections are slit so that one side forms a flap to cover the fore part of the shoes. The arms are made from the same kind of box, with three sides cut through at the elbow to form a flexible joint, so that the arm can be bent. A large box forms the main portion of the costume, covering the body. All four flaps at the bottom are opened to give the appearance of a skirt. At the top, two of the flaps are opened outward at the sides to form epaulets. The other two flaps are sealed down and a hole cut through, large enough to admit the head of the wearer. Holes are also cut in the sides to admit the arms. The box for the head is completely sealed, and then a hole is cut through at the bottom. This box is not fastened to the other but merely rests on it. Excelsior sewed to the upper box makes highly appropriate whiskers. The whole thing is quickly made and offers a complete disguise.—Leon I. Thomas, Oak Park, Ill.

Lock for Dial on Telephone

In an office where the dial telephone was located so that anyone in the office could make private calls at the company's expense, in many cases long-distance calls, it was found necessary to devise some method of preventing unauthorized use of the telephone. An ordinary small padlock was used to lock the dial, and this effectively prevented anyone from calling out, although it did not keep employes from answering an incoming call. It was estimated that the lock saved the office at least $50 per month.

Rheostat Controls Auto Charging Rate

I mounted a 6-ohm radio rheostat on the instrument board of my car, and ran wires to the generator, placing the rheostat in series with the third brush—the one that controls the strength of the field flux—thereby regulating the rate of charge. Then, I moved the control brush up to a fairly high rate of charge with the resistance of the rheostat all out. By cutting the resistance in, a very nice adjustment is possible. This eliminates the need of burning the lights to prevent overcharging the battery on long trips, and makes it possible to lower the rate when driving at high speeds, and to raise it when driving at night. Also, by turning the rheostat off, the field is open and no charge is given, which takes a certain load off the engine and does the generator no harm.—Harold I. Calkins, Lomita, Calif.



Replacing Auto Window and Door Glass

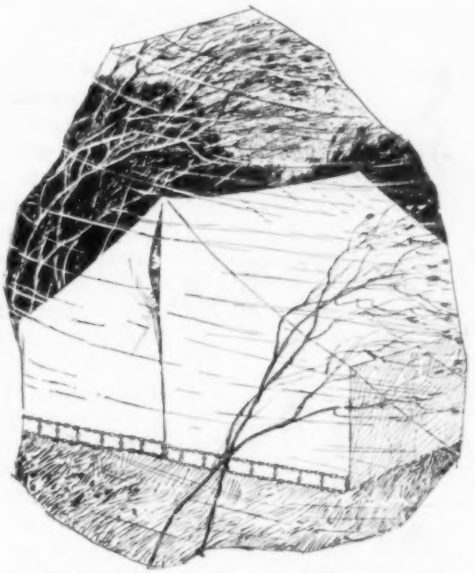
Replacing broken plate glass in the car is a rather tedious job unless the operator has some knowledge of the work. The first trouble encountered is in removing the broken glass from the channel. When this is done, the shattered pieces are usually broken into small fragments. The proper way to remove them is to obtain two small blocks of soft wood and clamp the projecting broken ends of the glass between the blocks in the vise. Then pull the channel away from the glass. In this way its removal is easy. When replacing the glass, be sure that you have it centered in the channel, and that it is of the proper size and shape. Stand the glass on its edge on a wooden floor and drive the channel down on it, but be sure to hold the glass perfectly vertical when you do this, and use a block of wood in driving down the channel, otherwise the glass may be broken. If the glass has a sharp edge, it can be smoothed easily by means of a file. This is less trouble than grinding and there is no danger of chipping the glass.

Sweeper for Golf Greens

Four brooms, held together by slats, make a good sweeper for the greens of a golf course. The handles are cut off the

Efficient Green Sweeper on Golf Course Is Made from Four Old Brooms

two end brooms and the handles of the two center brooms are left in place, permitting the worker to drag the sweeper over the green without difficulty.



Tire Chains Sewed to Bottom of Tent Flies Keep Them Shut in the Wind

Self-Closing Flies on Campers' Tent

To hold tent flies from blowing open in windy weather, it is usually necessary to fasten them with ropes or cords to pegs, and this causes more or less annoyance and loss of time when going in and out. To overcome this trouble a party of fishermen used a pair of tire chains, stitched along the bottom hem of each fly. The weight of the chains held the flies closed against the wind and yet allowed them to be swung open without the least trouble.

Full-Length Screen over Eave Troughs Prevents Stoppage and Overflow

Almost everybody likes a few trees around a home. However, the eave troughs may be choked by accumulations of leaves and other loose substances, and especially the down spouts. Wire cages are often provided at these points, but they plug up quickly. It is much better to inclose the whole gutter with screen. Narrow strips of galvanized or copper fly screen are placed over the tops of the eaves. The screen can be soldered on with little difficulty. When the leaves are dry, they readily blow off the mesh and cannot get into the gutters.—L. H. Georger, Buffalo, New York.

How to Put on Galoshes Easily

When wearing shoes with rubber heels it is often quite difficult to pull on a pair of galoshes, owing to the friction of the rubber against the fleece lining of the overshoes. To simplify the task, place a piece of wax paper in the position shown in the illustration, and you will find that the shoe will slip into the rubber without any trouble. The paper is left in the heel of the overshoe and may be used over and over again.—G. E. Hendrickson, Argyle, Wis.

Waterproofing a Serving Tray

Serving trays are frequently spoiled by liquid coming into contact with the embroidery, picture, or other work which may be placed beneath the glass to beautify the tray. In order to prevent this, a water-tight joint between the edge of the glass and the edge of the tray, extending over the glass, should be made. To do this, bicycle tape, about ⅞ in. wide, should be inserted into the joint. Remove the bottom of the tray, and then the glass. Clean the inner edge of the tray frame of glue and rough spots. Press the tape into the square corners around the edge of the frame. The four corners may be turned by cutting the tape on the upper edge and stretching it into the proper form. If the tape is cut in two at the corners, there is more likelihood of a leak. The open spaces in the corners should be filled with small pieces, but care must be taken not to form lumps. Replace the glass and see that it rests evenly on the tape all the way around, and reassemble the tray.

Roofing Tar Keeps Rats Away

Broken stone, glass bottles, sheet metal and other material of a like nature seem to do little good in the prevention of rats under porches and other similar projections of a home or other building. However, an excellent method has been found for keeping these pests away effectively. Get a small quantity of cold tar, the kind which is used by roofers for closing seams. This does not need heating. With a small brush apply a liberal coating on the inside of the holes and you will notice that the rats will practically disappear. Such an application need only be made about once every week for a short time during the summer months.—L. H. Georger, Buffalo, New York.

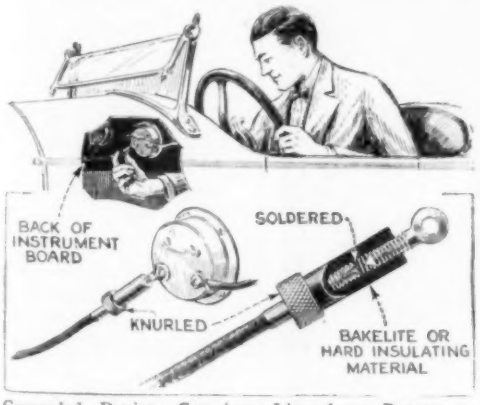
Chemical Flower Bed

For a few cents enough materials can be obtained to produce a chemical flower bed, such as is shown in the illustration. Get a small goldfish bowl or similar clear-glass receptacle. Fill the bottom with fine sand to a little over ½ in. Buy the following at any drug store: copper sulphate, 2 oz.; a few small pieces of pure zinc about the size of postage stamps; a piece of alum broken into small fragments and enough to fill a tablespoon; a teaspoonful of crystals of potassium bichromate; one can of water glass, and a 3 or 4-in. length of aluminum wire, cut into ½-in. pieces. Scatter the materials over the sand in the bowl in a "hit-or-miss" fashion. Mix one part of the water glass with three parts of water and pour the mixture slowly over the chemical-strewn sand, being careful not to disturb anything. The depth of the liquid should not exceed 4 to 6 in. Set the jar aside in

a place where it will not be shaken or jarred. Soon you will see queer little colored growths appearing here and there, which, in the course of a few days, will grow upward and assume various shapes. In about a week or two, you will have a chemical garden somewhat similar to the one shown in the drawing. Some of the larger puffy growths are whitish or yellowish and look like mushrooms or puffballs. Some are brownish and resemble other fungoid forms. Others are slender and green, and look like grasses and sedges. Still other growths are reddish and orange. Nearly every color of the spectrum is represented. Most curious of all are the growths which extend downward into the sand and along the sides of the glass. If not jarred or shaken, the chemical flower bed will last for several weeks. Then, like living things, the growths will slowly disintegrate.—Dr. L. A. Hausman, New Brunswick, N. J

Concealed Switch Prevents Theft

The concealed device shown in the drawing is a means of disconnecting the auto switch from the battery. It consists of a sleeve, made of hard insulating material, which contains a terminal with one threaded end, and another terminal with a knurled and a threaded end, to which the wire is soldered, as indicated. The inside of the insulating sleeve is threaded to correspond to these parts. In use, the parts are turned in one direction to break the circuit and in the other to complete it. This switch can be used on most circuits.



Concealed Device, Cut into Line from Battery to Switch, Helps to Prevent Auto Theft

Extra Legs on Stepladder

Most stepladders are a little wiggly. This trouble can be completely eliminated by providing two extra legs, as shown in the drawing. They are hinged to the top, and their outward swing is limited by lengths of sash cord. Holes are drilled through the center of the legs and the cord passed through and knotted on the inside. When folded, the extra legs take up little space, and when set up, they make the ladder steady and safe.

Extra Legs on Home Stepladder Give It Firm Support and Prevent Tipping Sideways

Paper Cups Serve as Funnels

While cone-shaped paper cups are generally used for drinking purposes only, their shape lends them to adaptation for other purposes. It has been found that they are especially useful as funnels. Just nip the bottom off, and the funnel is ready. Many motorists may find this a handy kink when filling up the vacuum tank, after running out of gas on a country road. Manufacturers of batteries also advocate the use of these cone-shaped cups for filling the cells with electrolyte. The slightly waxed surface of the paper makes it stand up under the action of strong acids.—A. S. Bowes, Chicago.

Make This Arms-Trophy Wall Piece

By Edwin M. Love

SUITS of armor are eagerly sought by collectors who are unhindered by financial restraints. Folk of ordinary means, as well, can have pieces reminiscent of the age of chivalry. Such a piece is the interesting wall model of helmet, sword and shield, illustrated in Fig. 1, based on a design of 1330 A. D. The cost of materials need not be more than $1.50, and only a little skill is required in the making of it.

The construction of the helmet, or "basinet," as this form was technically known, is illustrated in Fig. 2 and the drawings following. It is built up of papier-mache and "plastic wood," over ¼-in. mesh galvanized-wire netting. Cut a piece of netting, 8 in. square, and snip off the corners to form an octagon. Using for backing the lid of a shoe-polish can, or some other convenient article, hammer the netting up into roundness, as shown in Fig. 3, beginning with light blows in the center, and working around in circles toward the edges. Since this is a bending, rather than a stretching process, as in hammering sheet metal, there is an obstinate tendency to lopsidedness in the resulting piece; but by hammering down the folds with several thicknesses of paper for backing, as in Fig. 5, a fair degree of roundness can be obtained. In the original helmet, the headpiece was oval, but the model is made spherical, both to simplify the work and to reduce the depth from front to back, since it is to hang from the wall.

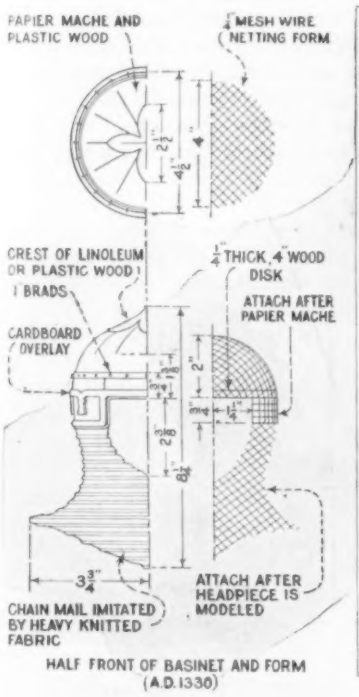
Having brought the netting to the form of a hemisphere, 4 in. in diameter, trim the edges even and nail to a 4-in. disk of ⅜-in. wood, to give rigid-

ity. Now make a thin paste of wheat flour and water, and build over the netting a thin shell of newsprint soaked in the paste, as in Fig. 6. Since it does not stick to the netting, lace it on with twine looped over the projecting edges of the mesh. Cover this with more paper, and again make a twine net over it. Set aside to dry, and, while it is drying, begin work on the shield.

Good work on the shield is more a matter of careful chiseling than of measuring. It is made of 1-in. pine, 8 by 9 in. in size. The pattern is copied from Fig. 7 by laying out a 4 by 9-in. paper rectangle in 1-in. squares, through the lines of which the outline is drawn, as shown. Trace one-half the shield, turn the pattern over, and trace the other side. It may be cut out with a compass saw, but perhaps the easiest way is to rough it out with a handsaw and chisel to the line, as in Fig. 8. Smooth with a spokeshave.

By this time the papier-mache should be dry enough for further work on the helmet. Cut a straight band of netting, ¾ in. wide and of such length that, when bent around the helmet just inside the edges of the top, a face opening, 2½ in. wide, is left. It is a simple matter to attach this by stitching with fine copper wire, as in Fig. 9, pricking holes through the paper with an awl or darning needle. This done, build up the whole piece with plastic wood, a 35-cent can of which is obtainable at any hardware store. Spread smoothly and firmly over the netting and paper, applying a small amount at a time, since it dries rapidly. Press the wood into the bare netting to a thickness of ¼ in. While trying for evenness, do not waste too much time in smoothing, for it is easily dressed to shape with a chisel. Allow it to set thoroughly before doing further work on it.

The first step in surfacing the shield is to carve a wide chamfer around it on the face side. Gauge a pencil line around the edge, ⅛ in. from the back, and one on the face, ¾ in. from the edge. Guiding on these, cut the bevel, as in Fig. 10. A wide butt chisel, honed very sharp, is best for this, although a narrower one will do. Work with the grain, with chisel bevel up, unless crossgrain is encountered. Do fairly accurate work. To cut the upper edge, which is across the grain, clamp the shield in a vise (see Fig. 11). Now work off the corners, and with careful strokes pare down the surface un-


PAPIER MACHE AND PLASTIC WOOD
¼" MESH WIRE NETTING FORM
CREST OF LINOLEUM OR PLASTIC WOOD
BRADS
¼" THICK 4" WOOD DISK
ATTACH AFTER PAPIER MACHE
CARDBOARD OVERLAY
3¾"
ATTACH AFTER HEADPIECE IS MODELED
CHAIN MAIL IMITATED BY HEAVY KNITTED FABRIC
HALF FRONT OF BASINET AND FORM (A.D.1330)

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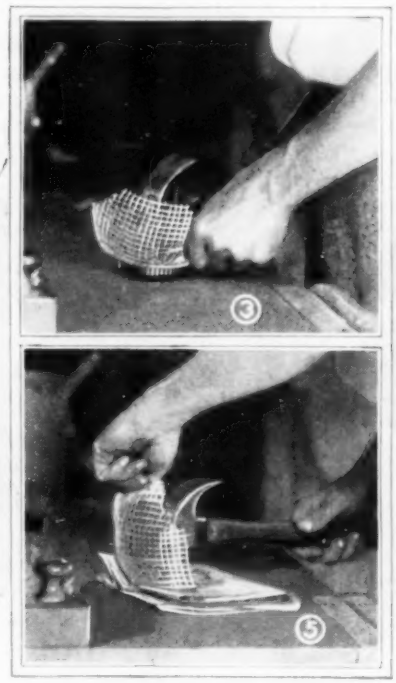
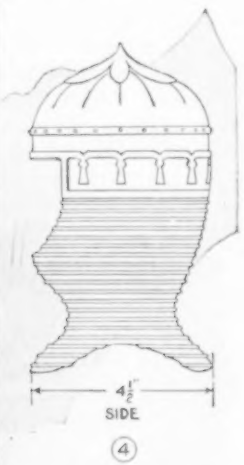




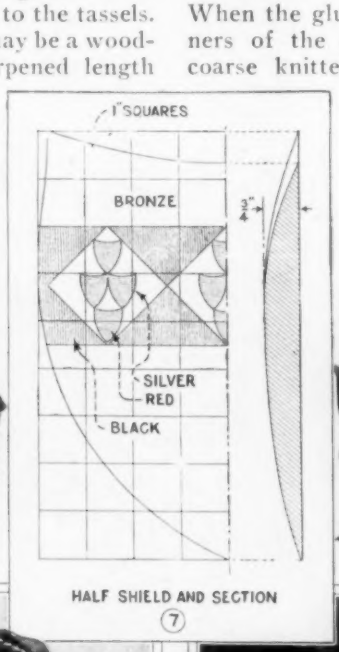
④

til it is uniformly curved throughout. Inspect it often from all edges, noting the high spots. When it is reduced to a good curve, scrub across the grain with coarse sandpaper, removing the chisel marks. Sand with the grain to take out the scratches and smooth with fine sandpaper.

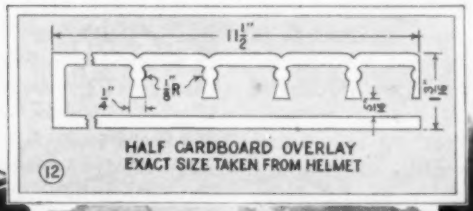
When the helmet is dry, trim and sand it smooth, rounding off all corners. Fig. 12 illustrates the cardboard overlay which ornaments the lower part of the helmet. It is cut from a strip, $1\frac{3}{16}$ in. wide, the exact length being found by measurement. Divide it in 10 equal spaces, forming a $\frac{3}{16}$-in. band all around, with conventionalized tassels, as shown, marking the divisions. The ends of these are $\frac{5}{16}$ in. from the border. Cut out with the point of a sharp knife and glue in place. A few wraps of twine will hold it tight while it is drying.

Centering on the top, describe a circle $1\frac{3}{8}$ in. above the face opening, and draw 12 equidistant radii pointing to the tassels. With a $\frac{1}{8}$-in. gouge, which may be a woodcarvers' eye tool or a sharpened length of umbrella bow (a three-cornered file can also be used), cut furrows, $\frac{1}{16}$ in. deep, as shown in Fig. 13. With a chisel widen these to $\frac{1}{8}$-in. V-grooves (see Fig. 14). Round the corners with sandpaper, and fix to the top with glue and brads the four-pointed linoleum leaf shown in Fig. 2. This crest ornament is $2\frac{1}{2}$ in. wide. Glue on an additional piece, $\frac{3}{4}$ in. square, and when dry, carve into the form shown, sloping gracefully from thin points to the peak at the center, with the edges also tapered thin. To facilitate carving, the brads may be removed. If preferred, the crest may be modeled with plastic wood.

A $\frac{3}{16}$-in. cardboard band is glued around the helmet with the upper edge $\frac{3}{4}$ in. above the tassel ornament. On the original helmet, this band apparently bore hooks that held the mail hood, but in the model the hooks are represented by 1-in. wire brads driven through the band above the tassels and centering between them. When the glue dries, smooth off the corners of the overlay and glue strips of coarse knitted fabric (such as material



HALF SHIELD AND SECTION
(7)



from an old sweater) between the bands, to represent mail, as shown in Fig. 15.

To hold the neck mail in place, make a form of netting as indicated in Fig. 2. This is bent around in cape shape and the narrow top opening is trimmed even. To form the inward bend at the neck, it is necessary to make a slit here and there for lapping. As Fig. 4 shows, it must bend in from back and front as well. The face opening is egg-shaped, 2½ in. wide and 2⅜ in. long from top to bottom. When properly shaped, slip the top inside the helmet and attach with wire stitches through small holes drilled in the plastic wood, tying inside. With tin snips, as in Fig. 16, trim the bottom edge to shape, giving a total length of 8¼ in. to the helmet, a front width of 7½ in., and a side width of 4½ inches.

To attach the "mail," fold a hem on the top edge and stitch through the netting with twine. Fold over the edges of the netting and sew with a whip stitch. To hide the rough inside, sew a piece of black velvet into the face opening when the painting is done. If an old mesh bag is available, it can be used for mail with good effect.

The sword stock is ⅜ by 1¼ by 1 ft. 10⅛ in. The blade length is 18 in. Reduce the hilt width to ¾ in., and taper the blade width from 1¼ in. at the hilt to ¾ in. at a distance of 1 in. from the point, and the thickness from ⅜ in. to 3/16 in. Round off the point as shown. Draw center lines on sides and edges, and with a chisel bevel the blade to the lozenge shape indicated. Finish with a plane and sandpaper. Whittle the pommel ¾ in. in diameter, and round the edges of the grip as shown, its greatest width being ⅝ in. The width at the blade is ½ in., forming a tenon to be straddled by the hilt, which is made of two pieces called quillons. The latter are made from ⅜-in. pine, ¾ in. wide and 4½ in. long. Whittle on each end a ⅜-in. ball, taper the edges to suit, and cut a ½-in. notch, 9/16 in. deep, in the center of one edge. Glue to the sword hilt and make solid with a brad driven through the front and clinched behind. Glue a small block of wood in the back and trim off flush.

The grip is wound

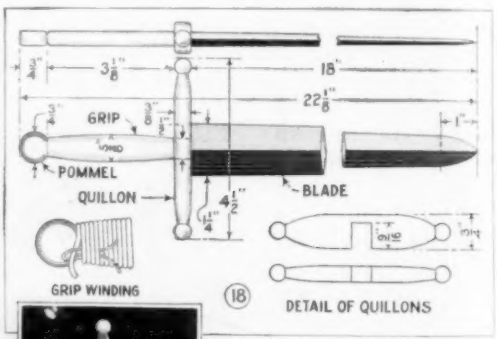
with ⅛-in. twisted cord. Carpenters' chalk line is good. To give more roundness to the grip, tie on each side a piece of paper, folded several times to give thickness. Drill a small hole just above the quillons to thread the starting end of the string through, and below the pommel, on one edge, gouge out a furrow, ½ in. long. Wind the cord tightly on the grip until this furrow is reached, when a loop of small copper wire is laid in it and covered with the four remaining turns. Pass the cord end through the wire loop, and with pliers pull the ends of the wire until the cord end is drawn under, as in Fig 18. Draw out the wire. The sword, ready for finishing, is shown in Fig. 17.

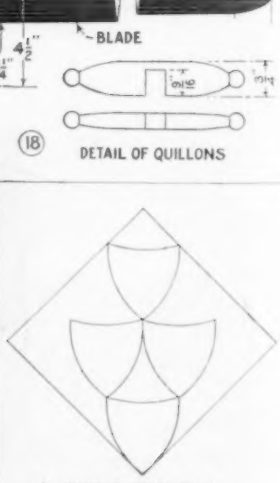
The finishing of the shield is typical of all. Apply with a small brush or rag a coat of orange shellac and allow to dry for a few minutes, until it is just barely tacky. Pour a couple of teaspoonfuls of shellac into a small lid and shake in enough dull bronze powder to make it of a creamy consistency. With two fingers smear this mixture uniformly over the shield, working with a circular motion from the left upper corner to the right and back until the whole surface is covered. Go over it a second time in the same way, and finally shake the dry powder liberally over it, rubbing it in. With a little care, a dry surface is produced which has a curious corroded-bronze appearance, polished in some places and dull in others. Allow this finish to dry well before attempting to add the decorations.

The ornamental bar is 2½ in. wide and straight, located 2 in. below the upper corners. Rule the edges with a pencil, and trace the center square ornament, shown in Fig. 19. Trace the other squares just touching the corners of the first. With a small brush carefully paint the squares with aluminum. When dry, trace on the small shields. Paint these vermilion with oil color, or with light red showcard color, which, in drying, shows minute cracks through which the silver shines. Lastly paint the background of the bar with black, the drying of which may be hastened by the addition of a little litharge.

Finish the helmet and sword hilt in bronze, and the sword blade with aluminum. If desired, a touch of color can be added to the helmet by coloring the bars silver and the tassels red.

To assemble the model, nail a 1¼-in.





wooden block 2 in. from the right corner and 1 in. below the top on the back of the shield, and to the center, just above the bottom point, two blocks forming a 3/16-in. groove at an angle of 20° with the center into which a stiff wire, attached to the helmet, is forced. Drive a wire staple about midway between the center line and left edge, near the top, as an additional support for the helmet standard. Nail the sword to the blocks, showing 2½ in. of the blade above the shield, and attach the helmet as shown by bending a stiff wire into suitable shape and tying it inside the netting with wire loops. The shield should slope from the vertical about 25 degrees.

If desired, two swords can be made, and the shield mounted with these crossed, and the helmet vertical in the center. If this is done, the swords should be half-lapped where they cross at the back, so they are no thicker than a single one.

Wax Seals on Jelly Tumblers

Homemade jellies or marmalades are often put up in glass tumblers and sealed with melted paraffin, which is poured over the surface. Although this method is sanitary and efficient, it presents some difficulties when the seal is broken, as the solidified paraffin often crumbles when it is removed, and the pieces become mixed with the contents of the tumbler. To eliminate this trouble, take a milk-bottle cap and place it over the contents of the tumbler, and then pour the paraffin over it, letting the tab of the cap project above the surface of the paraffin. It is then a simple matter to pull the cap and the paraffin off without the use of a knife or any other instrument. Pieces of cardboard or heavy paper may be used instead of caps if the latter are not available.

Pocket Palette for the Artist

Anyone who likes to go sketching outdoors with oil colors can make a pocket palette that will aid in reducing the equipment necessary to carry on such trips. The construction is clearly shown in the illustration, and it can be made from good grained cigar-box wood. Saw two pieces to the same size, sandpaper them smooth and then oil or shellac them. Cut a thumb and finger hole in one panel as shown and nail slides for the second panel around two sides and one end. These should be about ½ in. high. The second panel should have an end stop nailed and glued to it and is pushed into the grooves of the slides on the first panel until the stop forms the fourth side of a shallow box. The top consists of a third panel, hinged to one side and fitted with a hook, to close the box when not in use. For the sake of easy carrying, the total width should not exceed 5 or 6 in., so that the box can be conveniently slipped into a pocket.—L. B. Robbins, Harwich, Mass.

Artist's Pocket Palette Can Be Carried Along Conveniently for Sketching

¶ Iodine stains on clothes can be removed by applying a solution consisting of 1 oz. of photographic hypo and 2 oz. of clear water.

Simple Method of Effecting a Permanent Repair on a Leaky Ford Radiator

Simple and Effective Repair for Leaky Ford Radiator

The radiator on my Ford car recently sprung a bad leak. In outward appearance it was as good as ever and showed no dents or breaks anywhere. I found, upon inspection, that three tubes in the outside row were leaking near the bottom. I then drained off the water, removed the outside shell and cut a hole in the brass tank at the top, as shown in the drawing. The hole was cut over or adjacent to the tubes that were leaking. I plugged these tubes with strips of rag, forcing them down to the bottom with a wire. In doing this I completely filled the tube ends at the top with wood plugs. This prevented water from settling in them and avoided freezing in cold weather. Before closing up the hole I filled the radiator with water to make sure that the leak had been stopped effectively. I then folded back the lap of metal and closed the seam with solder. In this way circulation was cut out of three tubes of the radiator, but, of course, it is not desirable to close any more, as this would reduce the cooling effect too much. The method, however, is much better than putting in so-called liquid solders and other anti-leak compounds as they rarely effect a permanent repair, and very often do more damage than good, plugging the entire radiating system, with resultant overheating and lowered efficiency. My method was, perhaps, somewhat crude, but it worked and was done in about an hour's time. It was not even necessary to remove the radiator from the car.—H. L. Wheeler, Syracuse, New York.

Lamp Wick Waters Flowers in Owner's Absence

Did you ever go away for a few days and return to find the plants and flowers in the house drooping for want of water? Here is a simple and effective method of keeping them watered for a week or more at a time, with the assurance that you can return and find them just as fresh and green as when you left. Arrange two, three or four plants around a water container, such as a pitcher, bucket or small tub. The more plants there are and the larger they are, the larger the water container must be. Fill the container with water to the brim, and then bury one end of a large lamp wick in the dirt in each pot, and drop the other end in the water clear to the bottom. Also water the plants thoroughly before leaving. The wicks

Plants and Flowers Can Be Watered Effectively by Using Ordinary Lamp Wicks

will transfer the water to the flowerpots by capillary attraction and you will be surprised how much water has been absorbed by the soil at the end of a week. If lamp wicks cannot be obtained, it is

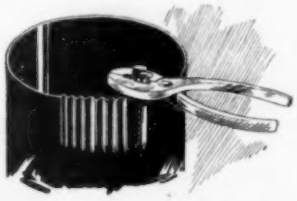
just as effective to use strips of felt rolled into tubular shape, or any soft loosely woven cloth, to transfer the moisture.

Repairing a Cracked Soil Basin

One of the children allowed the seat and cover to drop on the soil basin, which cracked the bowl between two of the little flush holes in the water channel inside, so that, when the bowl was flushed, a stream of water gushed out on the floor. A plumber tried to repair it by putting a patch of rubber and putty on the outside and lashing it on, but when the bowl was flushed it blew off. As this happened on Saturday, the plumber said he could not install a new bowl before the following Monday. In the meantime, I hit upon a handy plan that saved me a lot of inconvenience and the price of a new basin at that time. I mixed up a cup of plaster of paris to a fairly thick cream and injected it into the small holes near the crack with a glass dropper taken from the medicine cabinet. As the water channel was wet it thinned out the plaster, and let it flow into the crack where it could be seen oozing out on each side. The plaster was allowed to set a couple of hours, and when the bowl was flushed not a drop of water showed on the outside. The repair stood the test for eight months and was good when a new bowl was put in.—Mrs. P. H. Murray, Fall River, Mass.

How to Crimp Stovepipe

When fitting lengths of stovepipe together it is usually necessary to make crimps in the small ends of the joints so that they can be assembled more easily. This is difficult to do without a special tool, but by clamping two nails in the jaws of a pair of pliers, as shown in the illustration, the work can be done effectively. The nails are held at right angles to the pliers, and the improvised crimper is operated by placing it over the pipe end and twisting in a horizontal plane.



Focusing Shield for Box Camera

While taking pictures on a bright day, I found it difficult to shield the focusing glass with the hand and manipulate the camera efficiently at the same time. The difficulty suggested a simple shield, which proved very effective. A post card was folded and cut with rounding corners, and was attached to the camera by means of a rubber band. The shield shadowed the ground glass of the focusing lens so that the reflected objects could be seen clearly.—G. E. Hendrickson, Argyle, Wis.

Preventing Picture Marks on Walls

An easy method of preventing picture marks on wall paper, as a result of the dust collecting on the backs of the pictures, is to drive two small brads or tacks on the backs, about two inches above the bottom corners, to hold the lower edges of the frames slightly away from the paper. —Mrs. M. R. Wells, Cleveland, Ohio.

Roof Leaks around Chimney

Many roofs develop leaks around chimneys, which are not only difficult to repair but often continue leaking even though new flashings are provided. The proper method of repair in such cases is not to remove the flashing, but to cement the entire face of the flashing with a mixture of cold tar and sand, using the same quantity of each. Apply it with a brush so that it can be worked into the crevices around the brickwork as well as at the flashing, and there will be no more leakage.

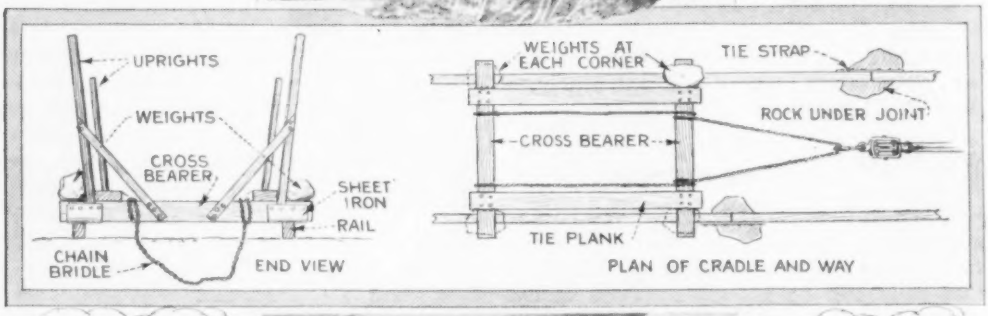
Laying Up the Boat for the Winter

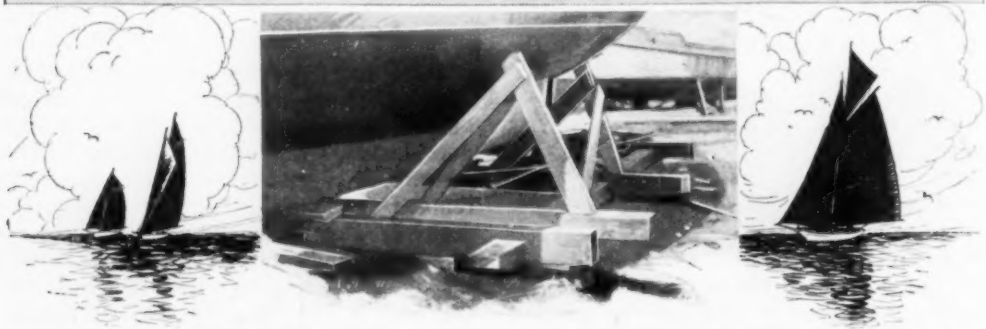
STRAINED timbers, unpainted wood and rust-bitten metal quickly spell disaster with a boat. The ravages of winter work quickly and soon take their toll unless the craft has been properly hauled from the water, blocked up and otherwise protected from the elements. Several hundreds, or maybe thousands, of dollars' worth of boat should no more be neglected than an equally expensive car.

Just when to haul the boat out is, of course, somewhat dependable upon location and inclination. Most boating enthusiasts put it off until the last gasp and one cannot blame them. But to do the work properly and make a sure and safe job of it, the boat should be hauled out early enough to avoid hurry and carelessness. Only small craft, like sailing dories, shallow-draft boats, small motorboats and practically any boat under 18 ft. in length can be hauled out quickly at the last moment. Deep-draft boats, and those of considerable length and weight, require time and thought, and one should get busy some time in October or the first of November, at the latest.

However, locations and time of year will set the rule. Northern localities, especially near fresh water, mean early cold and the job must be done before ice forms. In warmer climates, the hauling can be deferred until late in the winter. In any case, the reader must use his own judgment and arrange to haul up when he knows the time is ripe for his locality.

In salt water, arrange to put the boat on the ways near the full of the moon, to take advantage of the extra-high tides. The next best is to work on the tides at new moon. In fresh-water lakes, and rivers without tides, brute force at the winch must be entirely relied upon. Watch the papers and try to choose a period of quiet weather. Raise the moorings, or else let the chain drop with a marking buoy at-

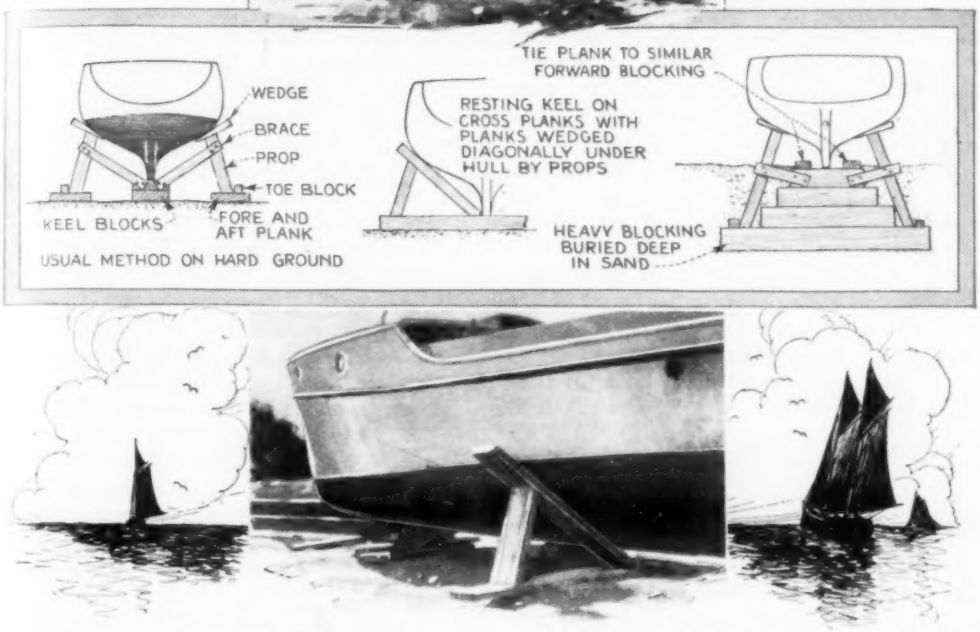




Top, This Boat Is Well Covered with Canvas; Center, Details of the Cradle and Way Used to Haul the Boat; Bottom, One Method of Cradling a Boat, Showing Props, Braces and Cross Bearers

tached, so that the chain can be picked up again in the spring. As the millions of broken ice will often break the heavy lines, it is even safer to tie a bundle

wisely and carefully from the start. A day or two before intending to haul, build the cradle and the ways. Construct the latter as far out on the beach as low


WEDGE
BRACE
PROP
TOE BLOCK
KEEL BLOCKS
FORE AND AFT PLANK
USUAL METHOD ON HARD GROUND
TIE PLANK TO SIMILAR FORWARD BLOCKING
RESTING KEEL ON CROSS PLANKS WITH PLANKS WEDGED DIAGONALLY UNDER HULL BY PROPS
HEAVY BLOCKING BURIED DEEP IN SAND

Top, Cradle on the Ways with Tackle Attached, Ready for Hauling When the Tide Rises; Center, Methods of Bracing Boats on Hard and on Sandy Ground; Bottom, a Good Method of Shoring on Firm Ground

of old wire to the chain before letting it go. Then, in the spring, it will be a simple matter to grapple up the wire after locating its bearings.

When the mooring is disposed of, bring the boat up to the dock or alongshore and pass all movable property, such as life belts, sails, tools, spare spars, galley utensils, etc., ashore where they can be safely stored. You will feel much safer by doing this than by leaving them aboard over the winter.

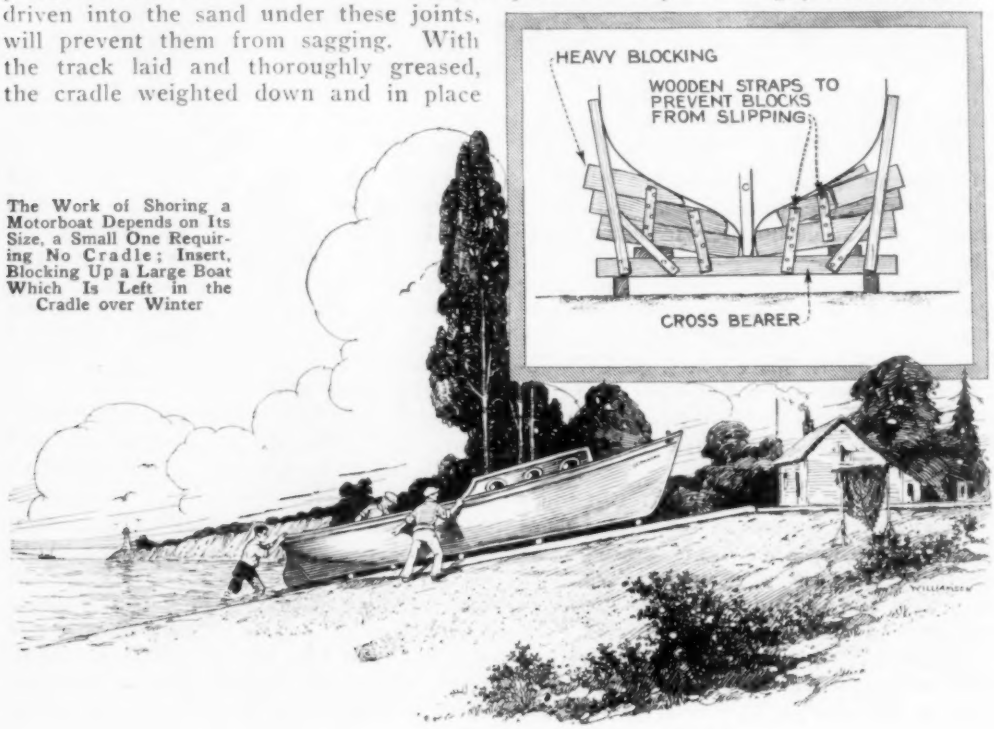
Small boats can be pulled directly upon the beach by means of several rollers placed under the keel, the rollers working over a single track of planks, and the boat is pushed and guided by several men. It can then be chocked up to rest on an even keel and covered with canvas. The deeper-draft boats, however, present real problems in engineering and must be handled tide will allow you to work; then the water will cover the cradle at low tide and still be deep enough to float the boat up to it. If posts cannot be driven far enough out to hold down the rails, their lower ends must be kept down by weights. Rails can be made of any straight timbers and should be well greased before they are lowered into the water.

The cradle consists of two heavy timbers resting directly across the rails and connected by two heavy planks bolted to them, parallel to the rails. The former are known as cross bearers and are often made of old railroad ties. They should be far enough apart so that the keel will rest on them without danger of any down sweep touching the sand and so that the weight of the boat will be well distributed. It should be thoroughly built and proper measurements taken before the boat is run

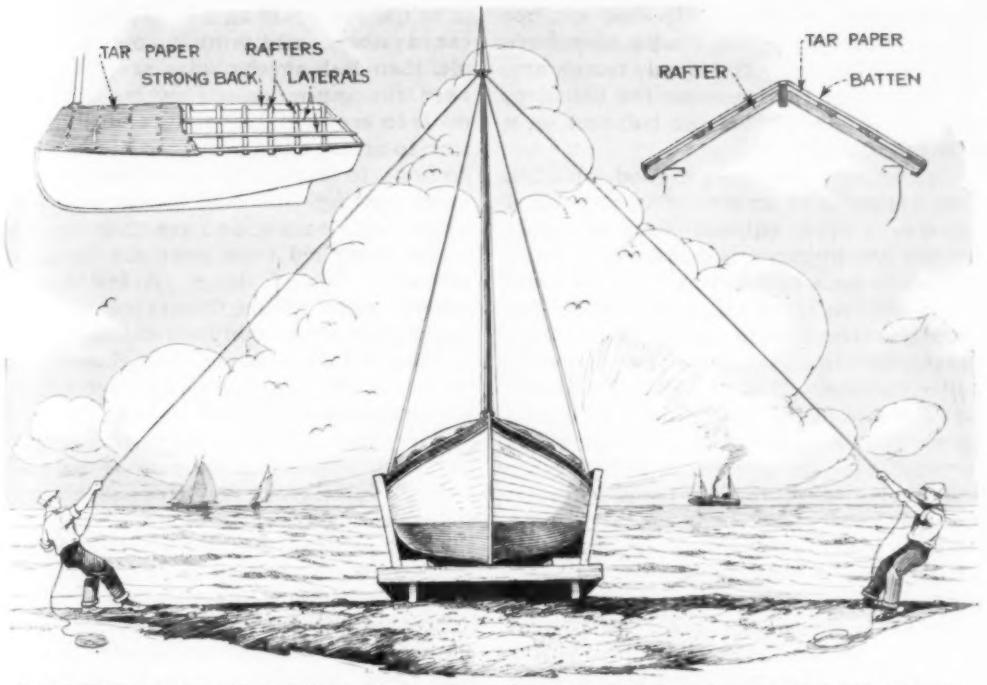
on it. If it can be conveniently done, nail some sheet iron under the cross bearers where they rest on the rails, and the sliding action on the rails will be much improved. Spike two heavy uprights to each side plank and brace them diagonally, inside, to the cross bearers, so that the brace will come under the boat's bilges. Take a hitch with one end of a heavy chain, such as a mooring chain, around one end of the rear cross bearers and lead it forward where a couple of hitches should be taken around the forward one. Then leave sufficient chain to make a bridle and return the chain along the opposite side of the cradle in the same manner. The bight in the bridle should be several feet long, as indicated in the diagram, to allow plenty of play in adjusting the tackle. Weight the cradle at both ends to hold it down in the water, then attach the hauling tackle to the bridle in readiness for the pull.

Lay the track in as straight a line as possible and all rails at the same pitch. Stagger the abutting ends of the rails so no two ends will come opposite each other. Tie the planks together with short pieces of board nailed to the sides. Rocks, driven into the sand under these joints, will prevent them from sagging. With the track laid and thoroughly greased, the cradle weighted down and in place and high water coming in, the boat can be run into the cradle. Have an anchor line on the after deck as well as forward. Attach guy lines to the masthead, if it is a sailboat, and to the highest points on a motorboat and lead them to each side. If it is a motorboat that is to be hauled out, be particularly careful not to crush any outside piping or connections running along the bottom of the hull. The rudder and propeller should be unshipped just as soon as they can be reached in the water. Head the boat into the cradle at the flood of the tide and under slow headway. Enter it slowly and carefully until the keel rests at about the proper point. If the keel fails to touch, haul up the cradle slightly and follow it with the boat until the keel rests on the cross bearers firmly and steadily. With a heavy boat, it may be necessary to throw out the stern anchor before the cradle is reached and check the speed slowly by snubbing the line around a stern cleat.

When the boat is squarely seated in the cradle, fasten the bow line and take up on the stern-anchor line until both are taut. This holds the boat from slipping from position. Pay off the guy lines from the



The Work of Shoring a Motorboat Depends on Its Size, a Small One Requiring No Cradle; Insert, Blocking Up a Large Boat Which Is Left in the Cradle over Winter



How Sailboats Are Kept Upright When Shoring Them; Details Show Method of Covering the Boat with Tar Paper in Order to Keep Out the Rain and Snow

mast or deck house and fasten them securely so that the boat will remain upright as the water recedes. Use care with this, for if a heavy boat tilts suddenly because a guy line breaks, it may mean broken planking or other serious damage to the hull. Take in any slack that may show as the boat settles into its cradle, and do it often. This can best be cared for by inserting falls into the line. As soon as possible, wade out into the water and chock up under the hull with short blocking, laid over the cross bearers and spiked together to hold. If the tide still flows in, haul the boat up as much as possible during the flood to gain the most benefit from its lift. As the tide recedes, go out with a scraper and a stiff broom and clean off all the barnacles and marine growth from the outside of the hull and scrub the bottom clean.

Then commence the haul. If a winch is not available, the work can be done by several strong men at the end of a three or four-strand tackle attached to the bridle of the cradle. Line them up the track and, if possible, take advantage of a favoring wind. Keep the tracks well greased all along and have one man stand by with a maul and a couple of wooden wedges. A tap with the maul on the track joints will help the cradle over them, if it tends to stick, and a wedge can be driven under the cradle if, by any cause, it starts to slide back. Let two men handle the guy lines and thus always keep the boat upright. A low boat can be steadied without guy lines by lashing a rope about it and the cradle when the latter is clear of the water. Every boat should be chocked solidly just as soon as it is possible to steady it. Haul the boat far above the high-water mark, for in winter this always exceeds that of summer storms. In fresh water, haul well above the storm line. Here tides are left out of consideration in all operations, and hauling, cleaning and beaching must be done from a fixed water level.

At the top of the track comes the job of shoring up. This consists in blocking the hull up rigidly and permanently for the season, which must be done carefully to withstand the washing out of sands, the pressure of severe winds and all forces of the elements. The simplest way is to

leave the boat on the cradle—but it is not always the best. The cradle may have been built hurriedly and is only temporary. The best way is to remove the blocking, then the cradle and let the hull rest on a firm foundation.

To shore up and make a good job of it, first gather a number of good, solid wooden blocks, railroad ties, or other equally strong material, and place them under the keel at points where they will bear the weight of the boat evenly distributed. Then build up on these with the smaller blocks until the latter fit snugly under the keel. Place some heavy planks on each side of the hull, parallel to it, and bury them slightly. Cut two or three props for each side, as shown in the diagram and photos, and, resting their butts on the planks, incline them slightly under the hull so the two meet. Wedge short planks between the tops of the props and the keel diagonally under the hull and drive smaller wedges, as indicated, until the hull is absolutely rigid. With this arrangement, it cannot fall or tip unless the earth underneath gives way. It is safest to fasten the bottom ends of the props in order to prevent them from slipping out.

If the beach is so sandy that there is danger of its washing away, it is necessary to build up heavy blocking from a trench in the sand to hold the boat's weight. Otherwise, any undermining of the sand will cause the props to drop from under the boat, which may seriously strain it. Build up a solid triangular blocking from the bottom of a deep trench running in the direction of the cradle cross bearers. The top log should come about level with the beach. Do this at both ends, just in front of the cradle. Tie the top logs together by spiking heavy planks to them on each side of the keel. Rest the keel-blocks on these. Then heavy props can be placed on these planks and wedged in the manner just described, blocking the toes of the props to prevent them from slipping. When completed, carefully undermine the cradle and remove it from under the boat, then fill in the trenches and tamp them down.

An open boat must be covered. This can best be done by using heavy canvas, such as an old sail, or a canvas cover made to fit. One method of covering a sailboat is to use the boom as a ridge, draping the canvas over it and tying it down fore and aft, then lashing the sides several inches over the gunwales. This lap must be made to keep out drift snow and sleet. Be sure to arrange the canvas to dip in all directions to carry off rain water or that from melting snows. Patch any torn places before using and see that the canvas is stretched tight over the frame to prevent it from leaking. A few narrow boards, running lengthways of the boat under the canvas, will help holding it out, making a better water shed than if the canvas is allowed to sag and stretch, thus forming into pockets.

Tar paper can also be used for boat covering where canvas cannot be procured. First make a "strongback" consisting of a timber, running the length of the boat and lashed to the masts or otherwise centered. It acts like the ridge of a roof. Nail light wood to it down to the gunwales and far enough apart to take the width of a strip of tar paper. Lastly, over these "rafters," nail more light strips, running parallel to the strongback and about 30 in. apart. This forms a lattice with 30-in. squares. The paper can then be tacked to the rafters and battened down with laths outside, to prevent it from tearing and allowing water to leak in. If it is properly made, such a cover will prove weather-tight and inexpensive. Light lumber can be used and, in the spring, the pieces can be numbered, taken down and stowed away for another year's use.

All standing spars should be doped with a mixture of linseed oil, tallow and yellow ocher. Mix and warm until the tallow melts, and then the ingredients can be stirred to a paintlike consistency. Apply while warm with an old brush, starting from the masthead and working down. If spars are removed before laying up the boat, which is the best method, they can be laid on horses or blocking and doped in the same way. It protects them from the weather and prevents cracking. All other exposed varnished surfaces can be treated in the same way with very good effect. Cover the masthole with a canvas boot or tar paper to keep out the water.

With sailboats the rudder should be removed or well lashed in place to prevent it from swinging in gales. Make sure the

centerboard is well up and fastened, or it may drag during the hauling and split or break off. We have already assumed that the propeller has been removed. Open the cabin ports slightly, to give a little ventilation, but batten down all hatches and companionways into which snow or rain might drive. Open all seacocks, toilet drains, bilge ports and any other plumbing that might freeze and burst if water is left in them.

The removal of the powerplant from either motorboat or auxiliary is optional and conditional upon the needs of the engine or transmission. In small boats, it is an easy job to take out the engine but with a large boat the task becomes heavy and complicated. Much of the overhauling can be done aboard, but when the engine is in bad shape it is best, if possible, to remove it and do the overhauling indoors. If the engine is to be left aboard until spring, a few general precautions for the winter's housing should be taken. Drain the water jacket and the pumping system and remove the plug from the jacket. Also remove batteries, spark coils and any wiring that may become saturated with moisture. In fact, it is wise to rewire each year with heavy cable and thus insure yourself against defective wiring and possible ignition troubles while at sea. Remove the magneto from the engine and store it, as well as the spark plugs, in a dry place. Before taking the ignition system apart, run the engine a few moments with the water drained off, in order to heat and dry it out. Remove the exhaust and intake ports and stuff with rags and also close the water-pipe openings and spark-plug holes in the same manner. Pour a pint or so of heavy oil in each cylinder and then turn the engine over by hand, to distribute the oil over the cylinder walls. Paint the engine with a mixture of white lead and tallow, to prevent it from rusting, and throw a piece of canvas over it as a final precaution. Then pull out the packing from the propeller stuffing box on the skeg and fill the gland with the same "dope" as was used on the engine.

In a sailboat, remove all the ballast and pile it outside. Then clean the bilges of water and mud and dry out by some safe heat. Give it a couple of coats of white-lead paint, being careful to keep the limbers clear. These latter are the openings cut in the bottom of the ribs to lead bilge water to the lowest point. Then replace the bilge flooring.

With all these details completed and the cover over the cockpit of a full-open boat, you may feel well assured that you will find the craft in prime condition when spring returns. Lack of such care will invariably mean a rotting interior, impaired machinery and, perhaps, a punctured or sagging hull due to careless shoring. This means expense and constant trouble. The time and material spent in preparing the boat for winter will pay dividends every time, and in more ways than one.

Road Map Mounted on Spring-Roller Shade Is Convenient

Ordinary maps are rather difficult to handle as they are quite large and therefore are apt to be torn easily. The difficulty was eliminated in one case by attaching an ordinary shade roller to the windshield, and gluing the map to the shade, as shown in the drawing. Whenever it is necessary to look at the map, the shade is pulled down and after consulting the map, the shade is rolled back.—T. F. Krey, East Orange, N. J.

The Road Map Is Mounted on a Spring-Roller Window Shade Attached to the Auto Windshield

Non-Scratching Emery for Polishing

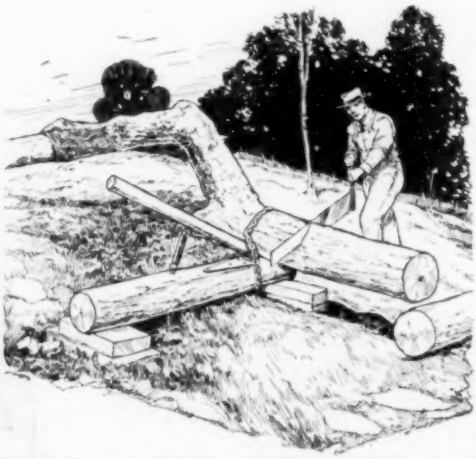
There are many instances where emery would be used for polishing purposes if it would not scratch. Non-scratching emery can be obtained by the following simple method: Take any bottle, which will hold practically ½ pt., and fill it with 7 parts machine oil and one part flour emery, by bulk. Shake the bottle well for a few moments and then let it stand for a half hour. You will find that, after settling, some of the emery will be suspended in the oil. Pour this top liquid into another bottle without disturbing the sediment on the bottom. The liquid poured off contains the finest particles of emery, which will not scratch.

Marking Position of Sewer Pipes

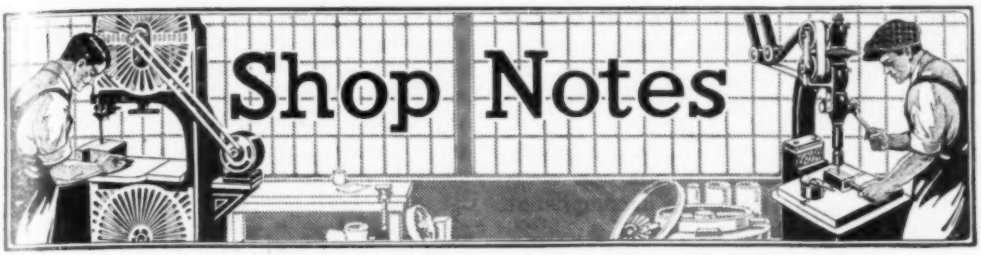
Sewer or water pipes not laid in a straight line may be easily marked by laying a row of brick on or near the surface of the ground, where they may be located in case of trouble. Joints may be marked by laying a brick directly over them, sideways. This method will prove a great timesaver when it becomes necessary to get at the pipe, especially if new pipe is used, which may not require attention for several years.—Charles E. Forgette, Plattsburgh, N. Y.

Clamp for Logs and Knotty Sticks

If one of the shade trees about your cottage dies or is blown down, its ornamental usefulness may be prolonged by turning its trunk and gnarled limbs into rustic seats and tables, attractive supports for plant tubs, sundials, gates, pergolas, etc. However, it is usually difficult to saw the trunk and heavy limbs on trees lying on the ground. A great convenience in doing such work is the clamping device shown in the illustration. It will hold the crooked and knotty sticks firmly in any desired position for sawing, drilling or attaching other parts. It is made of a hewn piece of timber, about 4 ft. long, which has a V-shaped notch close to one end and two supporting blocks nailed to the underside. It can also be made of two pieces of 2 by 6 or 2 by 8-in. lumber, nailed together. A lever is attached to it with a stout strap hinge, and a coil spring, not too long but stiff enough to exert a strong pull, is fastened between the parts by means of two screweyes.



Strong Clamp for Holding Tree Trunk Lightens Labor of Sawing It



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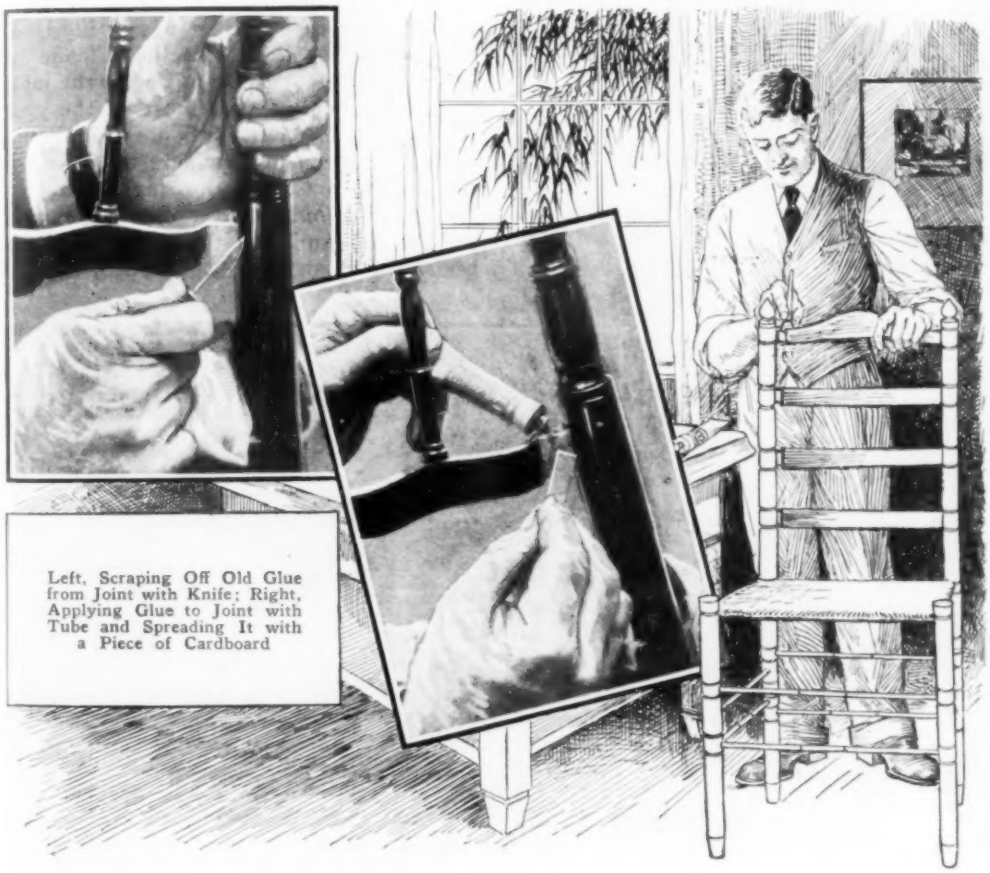
Glue and Its Use Around the Home

By L. B. ROBBINS

MODERN glues come both in the flake or crystal form and as a liquid. Today the latter is most generally used because of its handiness, keeping qualities and adhesive powers. Of course, the hard glues can be converted into liquid form with a little trouble and in some cases may even be preferable to the liquid stock. The uses for glue around the modern home are many. Probably every family has a chair, picture frame, or whatnot, that is discarded because a rung or a portion of it has become disjointed. Statuettes may have become broken, book

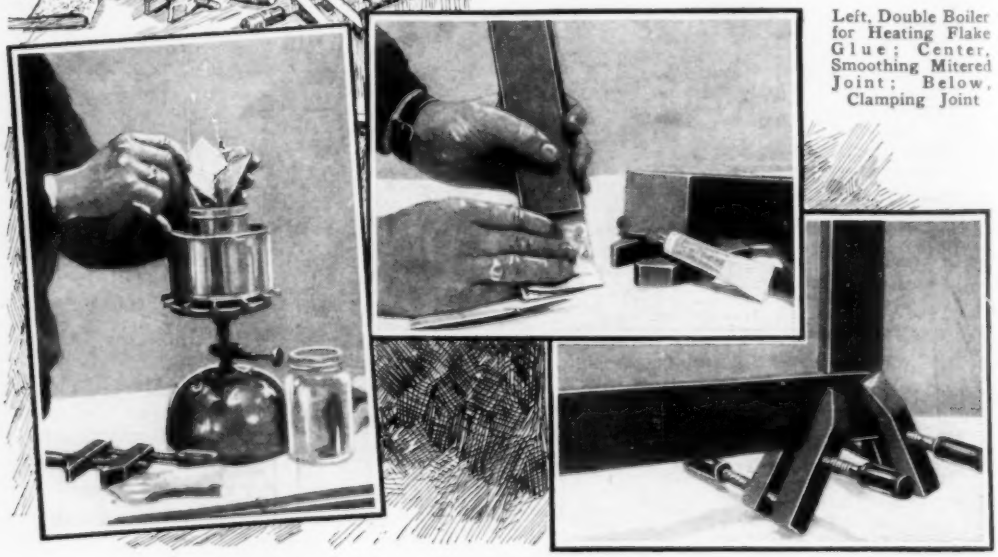


Left, Scraping Off Old Glue from Joint with Knife; Right, Applying Glue to Joint with Tube and Spreading It with a Piece of Cardboard

covers torn off or veneer has parted from its foundation on a costly piece of furniture. The children can be amused for hours by making cardboard toys with the aid of glue. In fact, ten cents' worth of glue will pay a bigger dividend than any other household necessity one can mention. It is simple to use and accomplishes wonders when properly applied.

For home repairs wood is probably the material most to be reckoned with. Now, let us suppose a valuable chair has loosened up in the joints so it is almost unsafe. The proper procedure for making a permanent gluing job is about as follows:

First, separate the jointed portions so they are entirely exposed. Scrape off the old glue clear to the wood and dig it out from all of the holes and crevices. A sharp knife blade or freshly broken glass can be used for this. Then sandpaper to smooth the surface and give it a tooth. Be sure both surfaces of the joint are clean and dry; then apply a thin coating of glue direct from the can or tube. Allow this first coat to nearly dry so it feels quite "tacky" to the touch. Then apply a second generous coat and let that, too, become tacky, and finally fit the joints together evenly and as firmly as possible. In the case of a chair or any irregularly shaped object, the pressure may have to be maintained between the glued parts by tying with strong cord. With picture frames and flat surfaces glued together, the parts can often be clamped, using common carpenters' clamps or boat clamps to press the parts together. Any glue that oozes out from the joint under pressure should be allowed to set nearly hard before removing it with a knife blade or other suitable tool. Do not press the joint so hard, however, that most of the glue will be squeezed out, for some of it should remain between the surfaces to make the job a good one. By allowing at least 24 hours for a joint to dry, you will have a perfect job and one that will stand up under the most trying conditions.



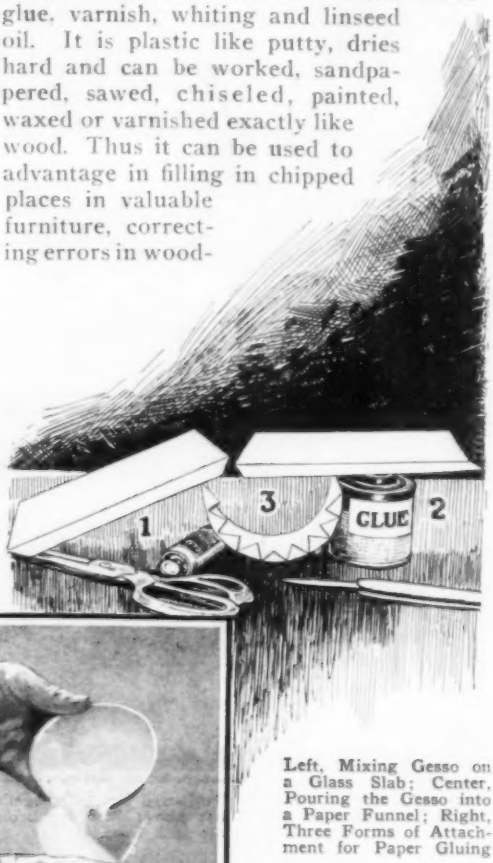
Left, Double Boiler for Heating Flake Glue; Center, Smoothing Mitered Joint; Below, Clamping Joint

New wood should be properly fitted before gluing and made thoroughly dry before applying the glue. For soft woods, it will be well to allow a thinned coating of glue to sink into the pores before applying the two regulation coats as just described. This will increase the holding power considerably.

Now a word regarding the use of hard glues. The principal characteristic of hard glues are that they set quicker than liquid ones and must be dissolved and heated before applying. For general work, therefore, the prepared liquid glue is preferable, but where an especially solid joint is desired or when liquid glue cannot be procured, hard glue must be used.

First soak the glue until it is soft, using cold water. This will take from 4 to 12 hours, depending upon whether the glue is in pulverized or sheet form. Do not prepare the mixture by guesswork. Use enough water to thoroughly soften the material but not so much as to dilute it. When soft, put the glue into the pot and add a little water as the glue heats and melts. Use a double boiler and slow heat, making sure there is plenty of water in the outer jacket of the boiler. A good boiler can be made from two tin cans, as shown in one of the photographs. As long as water and glue are kept in the cans, the solder cannot melt from the heat. Use a thermometer during the melting process and be careful not to let the temperature rise above 160° F. If glue is allowed to become too hot, it rapidly loses its strength and, if this excess heat is continued, the glue will be ruined. Apply to the job while warm and in a fairly fluid state, setting the work instantly and clamping and tying it as has been previously described.

In recent years there has been revived a glue-impregnated material that was used by the ancients in molding decorative work and filling imperfections in handcraft articles. It goes by the name gesso and, in modern terms, is a combination of glue, varnish, whiting and linseed oil. It is plastic like putty, dries hard and can be worked, sandpapered, sawed, chiseled, painted, waxed or varnished exactly like wood. Thus it can be used to advantage in filling in chipped places in valuable furniture, correcting errors in wood-working, as a filler and in molding decorations on picture frames, etc. Gesso is simple to make and will keep indefinitely for instant use, if properly cared for.



Left, Mixing Gesso on a Glass Slab; Center, Pouring the Gesso into a Paper Funnel; Right, Three Forms of Attachment for Paper Gluing

Put a cup and a quarter of whiting in a mixing bowl or on a glass or marble slab. Then pour in the center of the whiting, stirring all the while, a gill of best

Bottom, Sheets of Paper or Cardboard Pressed Together Firmly by Rolling with a Mailing Tube; Above, Mending Broken Plaster Ornaments with Glue

grade liquid glue, three teaspoonfuls of linseed oil and three teaspoonfuls of varnish. Stir slowly for two or three minutes and until the ingredients are mixed thoroughly and smooth. If the mixture is oily and does not stick to the bowl or slab, add a little more glue and stir longer. When ready, the mixture should remain piled up wherever it is laid and stick to the utensil or container. If the pile settles down, it is still too thin, and a little whiting should be added until it acts like an immobile mass that can be molded as desired. If too thick, add a little water. By placing the gesso in a fruit jar, covering it with a little water and sealing the cover, it will keep indefinitely. Just pour off the water and it is ready for use.

Now suppose you have built a cabinet and one of the joints shows an unsightly gap. Just fill the gap with gesso and let it harden. Then it can be shaved or planed down, sandpapered smooth and finished with the same finish as the wood, and the defect will hardly be noticeable. Suppose a sliver is torn from a hand-carved ornament. Instead of attempting to fit a piece of wood to the break, just mold the surface up with the gesso and finish it to match. Broken decorations on elaborate picture frames can be restored with gesso so as to go undetected, and chipped pieces from statuary filled in as well. A gesso joint has about one-third the holding power of a pure-glue joint, but is sufficiently strong for all ordinary purposes. It is also a good filler and putty substitute. It will fill countersunk holes better than a wood plug. Gesso can be best applied to a long open joint by pouring it into a rolled paper funnel and allowing it to run from the small end. This method can also be employed when molding raised figures on a frame.

Making paper and cardboard toys and decorative objects, such as lampshades, is fascinating work, but certain rules should be followed to get the best results. First, do not use too much glue and remember that liquid glue is much to be preferred for this work. Squeeze just enough from the tube to cover the surface to be cemented. Spread it evenly over the material with the spreader or a piece of card-

board. Let it become almost dry and then lay the second piece over it and press together. This method will prevent the surfaces from slipping, and the glue will dry quickly. A few heavy books piled over the joining will hold it solid until dry, or two thin pieces of wood, one on each side of the material and held tight by a pair of clamps, will make the job easy.

In making paper objects there are three essential methods used in joining two abutting pieces. One is by means of a flange. This consists of a narrow strip of material, folded lengthways, with the ends of one half clipped off at at angle. This is used in joining two edges meeting at a sharp angle. A hinge is used to straddle a joint and is similar to a flange except that both ends of the piece are beveled. When a flange is to be bent around a curved piece, it must be saw-toothed and the teeth glued to the face of the circular part. All three are shown on page 863.

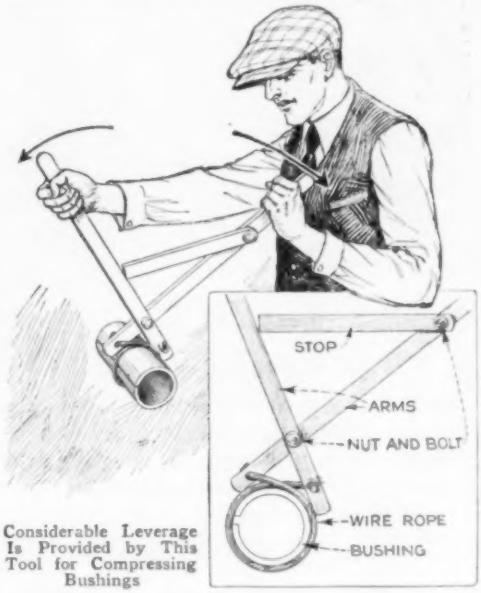
Keep the scissors sharp for paper working and have a clean cloth and bowl of water handy to wash and dry the fingers occasionally. A good method of smoothing a glued surface and removing all air bubbles, before putting the work in the press to dry, is to use a piece of mailing tube as a roller. This thoroughly presses the surfaces together and is an inexpensive tool that you will find it easy to pick up almost anywhere.

Mending plaster casts and similar objects should be done carefully to insure a lasting job. Dry the surfaces by holding the article over a slow heat for some time. Then thin down a little glue with water and thoroughly soak it into each surface until the pores are filled. After that apply one coating of normally thick glue, letting it nearly dry, then the final coat, and press into position for drying.

The illustrations that accompany this article fully illustrate the essential points in using glue, and if they are followed carefully, along with the directions, you should have no difficulty in doing a satisfactory job. Remember to use only a good grade of glue for good work and do not hurry. You can save many dollars' worth of otherwise useless furniture and household utensils besides constructing new things that will be a pleasure to use and to look upon.

Bushing Compressor

The use of split bushings is fairly common on certain kinds of machines, and a simple tool for compressing these, so that they may be easily slipped into place, will be interesting to many. Two pieces of hardwood are joined by a nut and bolt, to form arms, and a shorter piece is joined to one of the arms in the same way, to form a stop. Wire rope, of a length to suit the bushings, is slipped through holes in the arms and knotted. To operate the



Considerable Leverage Is Provided by This Tool for Compressing Bushings

tool, give the rope a single twist to make a loop and slip it over the bushing. Now pull the arms apart to tighten the rope and so squeeze in the bushing, and the stop piece will drop down and hold the arms securely, while the unwrapped part of the bushing is pushed into the handle. The tool is then removed and the rest of the bushing is tapped or pressed into place.

Method of Locating a Gas Leak

Never use matches when looking for a gas leak. The following method is much safer: Mix a solution of hot water and soap, making the water very soapy. With an old paintbrush apply the soapy water to the points where leaks are suspected. Bubbles will appear wherever there is a leak.—L. H. Georger, Buffalo, N. Y.

Coil Spring Attached to Pitman and Windmill Frame Facilitates Pumping

Coil Spring on Windmill

In a windmill, the upward movement of the pitman requires the most force as it is necessary to lift the total weight of the pitman and also the column of water which the pump is drawing up. Obviously, the windmill will start much more easily on a downward stroke because gravity aids in pulling the pitman down. To equalize the force required to raise and lower the pitman, a strong coil spring will be found convenient. It is attached to the frame of the windmill and to the pitman as shown in the drawing. The pump will then start easily in the slightest breeze.—H. J. Curley, Salem, S. Dak.

Paint Keeps Straw from Beneath Slats on Harvester

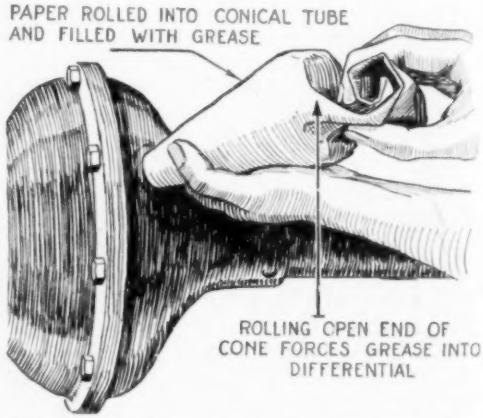
When harvesting, trouble is usually encountered due to straw pushing beneath the slats on the elevator and butter canvas, until these become clogged and slip, making it necessary to stop and clear away the straw. To prevent this trouble, I apply paint thickly along the canvas next to the front side of the slat, first oiling the edge of the slat with a rag so that the paint will not stick to it. The paint is laid on thickly enough to form a ridge on the canvas just in front of the slat, and so forms a guard to prevent the straw from sticking.—G. G. McVicker, North Bend, Nebr.

Modeling Clay for Casts

Modeling clay, which can be obtained in most toy departments of retail stores, is excellent material for use in casting simple objects in plaster of paris. When taking an impression, the object should be dusted with talcum and, after the plaster has been poured and hardened, the clay can be peeled off without difficulty. A Wisconsin window decorator saves many dollars with this compound by making small accessories for his displays.—G. E. Hendrickson, Argyle, Wis.

Emergency Grease Gun for Differential

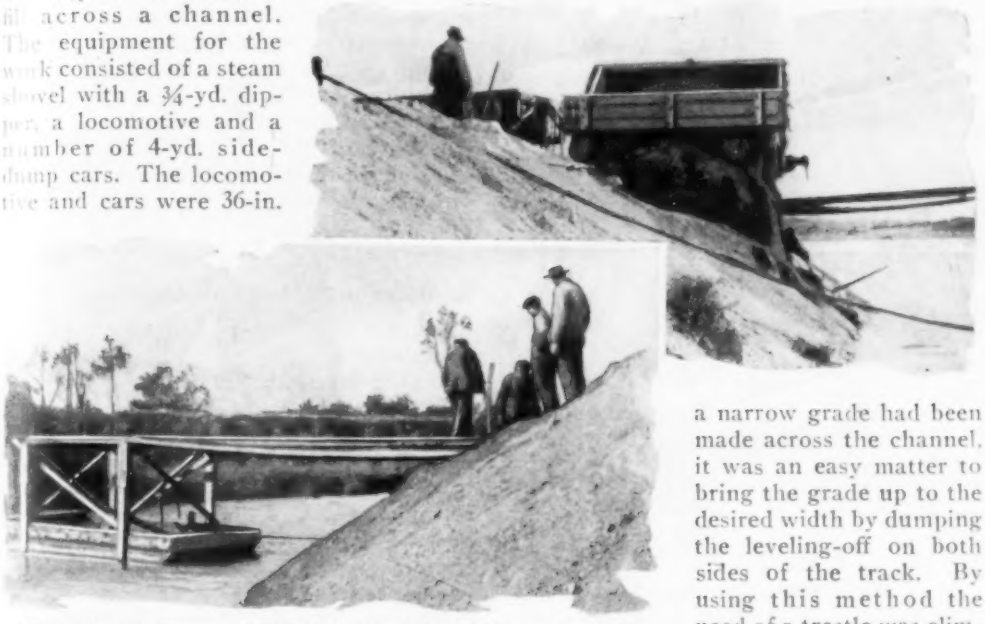
Filling the differential of an auto is a task which can easily be done with the emergency filler shown in the illustration, when a regular grease gun is not available. It consists of a piece of heavy wrapping paper rolled to the shape of a large cone. This is filled with lubricant, and the wide, open end folded over. To transfer the grease to the differential, tear off the point and slip the small open end into the filling hole. Then roll the cone like a tube of toothpaste, thus forcing the contents into the differential.—G. A. Luers, Washington, D. C.



Filling Auto Differential with an Emergency Paper Grease Gun

Making Earth Fill without Trestle

It was desired to strip the clay overburden on a gravel deposit and to use the clay to construct a fill across a channel. The equipment for the work consisted of a steam shovel with a ¾-yd. dipper, a locomotive and a number of 4-yd. side-dump cars. The locomotive and cars were 36-in. gauge. The water in the channel was 14 ft. deep, and it was desired to have the grade 8 ft. above the water. In order to eliminate the expense of building a trestle to carry the cars while dumping, a framework was built on a pontoon, 8 by 16 ft. and 2 ft. deep. This framework was to support the outer ends of two steel rails, weighing 65 pounds to the yard and 30 ft. long. The rails were clamped in the center to hold them to gauge, and were fastened to the frame of the pontoon and to the ends of the track on the shore. This allowed a clear space of 9 ft. for dumping between the shore and the pontoon. The arrangement also permitted the forward pair of wheels to run out over the edge of the fill so that the load could be dumped into the water.

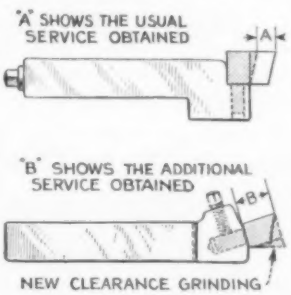


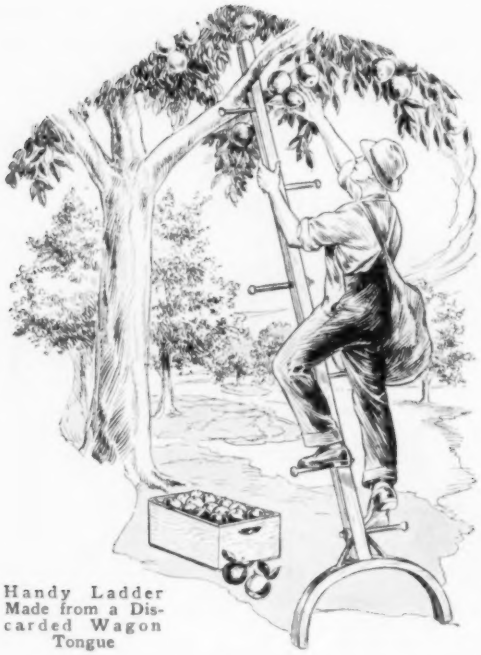
Eliminating the Expense of Building a Trestle for Making an Earth Fill

After the work of filling had progressed to the pontoon the rails were disconnected at the joint on shore, the pontoon pushed forward 9 ft., and the track laid in the gap on the new grade. This was repeated as the grade was filled until the pontoon was against the opposite shore. Two full-length rails were then connected to the rail ends on the pontoon and extended onto the shore on that side. The pontoon was then taken out. After a narrow grade had been made across the channel, it was an easy matter to bring the grade up to the desired width by dumping the leveling-off on both sides of the track. By using this method the need of a trestle was eliminated and the dumping was done in a highly satisfactory manner. —A. W. Burg, Lake View, Iowa.

Doubling the Life of Tool Bits

The life of tool bits of the turned-shank type can be prolonged by an average of approximately 100 per cent, by using the simple tool holder shown in the drawing. The upper detail shows the regular way of using these tools. A shows the amount of service obtained from a tool. Instead of scrapping the tool at this point, it is placed into the holder shown in the lower detail, and is ground with the proper clearance, which makes it good for more service than it has already given.—E. H. Dreider, Lancaster, Pa.





Handy Ladder Made from a Discarded Wagon Tongue

Wagon Tongue Makes Handy Ladder

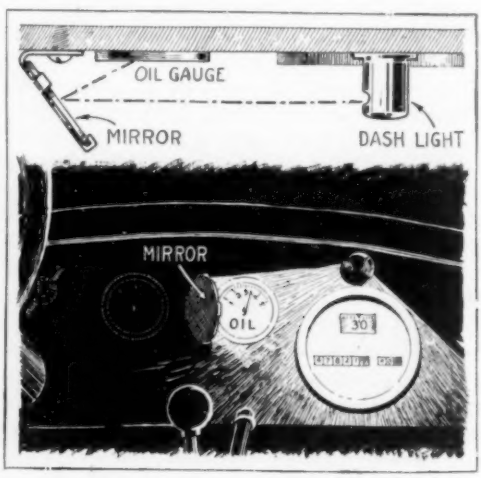
For use about his farm buildings, a Wisconsin man has made a serviceable ladder from a discarded wagon tongue, using bolts for rungs. The tip of the tongue, which had been broken off in an accident, was sawed off to provide a smooth end. Holes were drilled at intervals for the insertion of ½-in. bolts, 8 in. long. Besides the simplicity of its construction, this ladder commends itself on account of the ease with which it can be carried from place to place, and the width of its base, which makes it safe. It is especially convenient for use at stacks of hay or straw or for picking fruit, and may even be used as a binding pole when hauling fodder.

Glass as a Substitute for Tracing Cloth

Instead of using tracing cloth or paper, in instances where the tracing is not to be kept as a record, a plain sheet of glass makes a good substitute, and one that possesses certain advantages. A piece of glass that is perfectly clean and dry will take the drawing ink excellently, and no sizing need be used. The ink dries as quickly as on paper, and, when dry, the tracing may be dusted or wiped off without the slightest injury. When the tracing is no longer wanted, a damp cloth will quickly remove the ink, and the glass is then available for another tracing. The centers are located by means of a small piece of rubber, leather, or the like, moistened and placed on the glass. This gives a good rest for the point of the compass. This idea simplifies the blueprinting work, as it does away with tracing cloth, and a single glass will do for many tracings, besides which the glass always lies flat, without the use of thumbtacks, and the finest line is readily seen.

Reflector Illuminates Oil Indicator

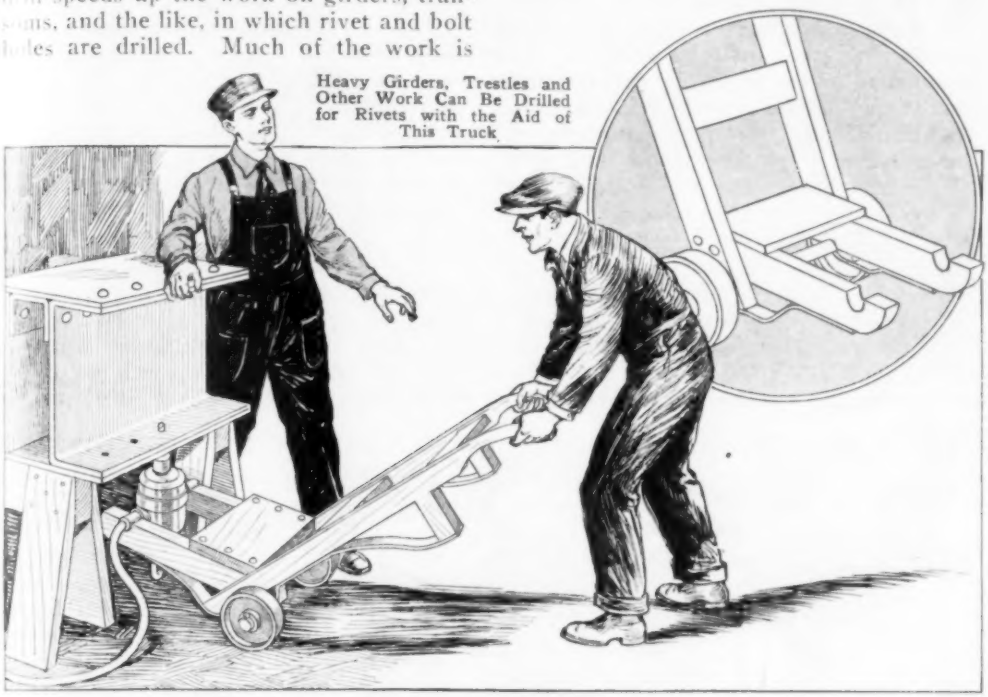
When the oil supply of an auto engine is diminished to the point where the pump fails, the burning out of the connecting rods or the scoring of the cylinders is almost certain to result. The dash oil indicator is visible in the day, but at night many drivers are unaware of the oil supply, due to lack of illumination. To safeguard the car by being able to read the oil indicator at night, a small dash lamp can be mounted directly over the gauge, duplicating the dash light over the speedometer. A simpler method, however, is to mount a small mirror on one side of the oil indicator, as shown in the illustration. The mirror, set in a sheet-metal holder, is fastened to the dash at such an angle as to direct the light from the dash lamp directly onto the indicator.



Reflector to Illuminate the Oil Indicator on the Auto Instrument Board

Drill Supported by Truck

A structural-steel workshop finds that the illustrated method of supporting a drill speeds up the work on girders, transoms, and the like, in which rivet and bolt holes are drilled. Much of the work is erected on low trestles and the greater part of the drilling can be done from below. Extensions are fitted on a truck to hold a drill, and the operator can thrust the drill up against the work by bearing down on the handles. The wheels permit the free movement of the drill from one hole to another, or around the shop. This truck is useful in any shop where drilling can be done advantageously from below, the height of the drill truck being determined by the height of the fixtures.



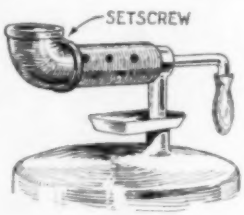
Heavy Girders, Trestles and Other Work Can Be Drilled for Rivets with the Aid of This Truck

Tightening Ford Door Handles

The later models of Ford closed cars have crank handles on the door-glass lifters, which fit over square shanks. The handles are secured on the shanks by small setscrews. The screws are a rather loose fit in their holes and the handles are not very strongly made, which prevents much tightening of the setscrews. Consequently, the handles often shake loose and fall to the floor of the car. They can be kept in place, however, by means of a small piece of heavy cloth, about ½ in. wide at one end and tapering to a point at the other. This is laid on the square shank of the lifters with the pointed end out, and the crank is then driven on by tapping lightly with a piece of wood and a small hammer, after which the setscrews are tightened. The handles will be more difficult to remove, but this is seldom required.

Useful Accessory for the Blowtorch

To direct the flame of a blowtorch upward against the bottom of a babbitt ladle or against small tempering plates, a gaspipe elbow can be used as shown in the illustration. A small hole is drilled and tapped in the rim of the elbow to receive a setscrew, with which the device can be attached.



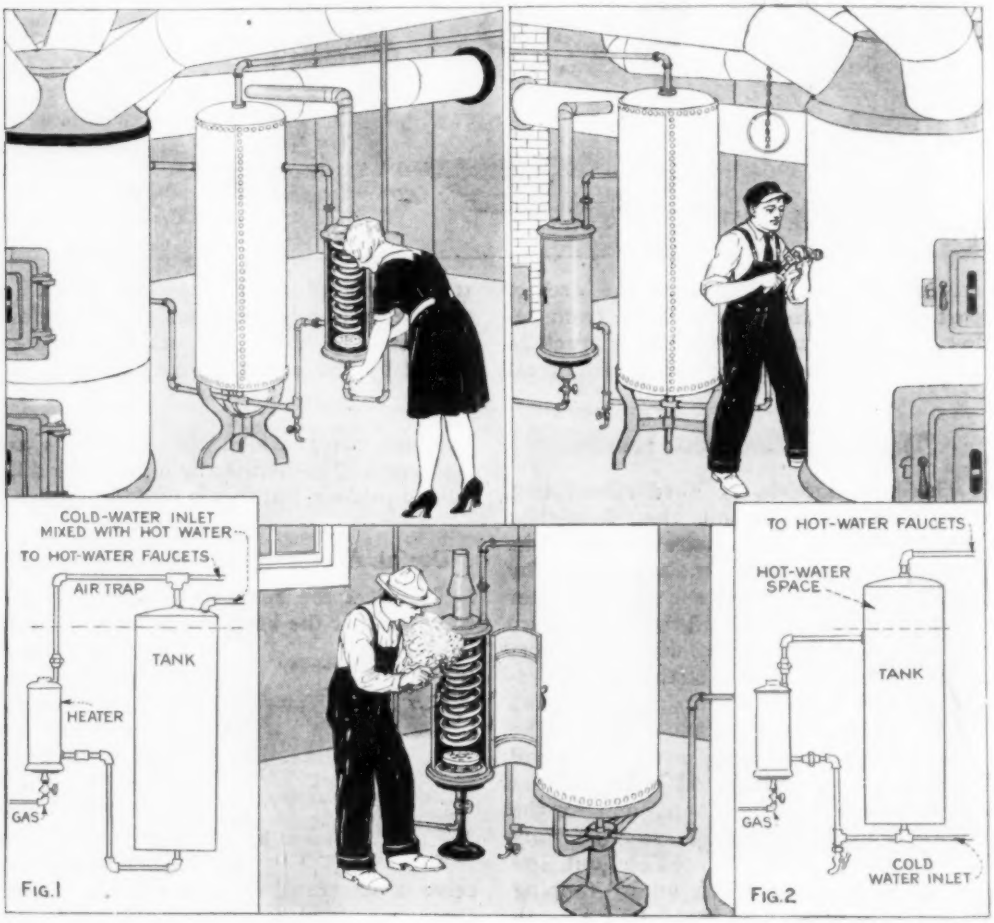
Hot-Water Heaters That Work

By ROBERT S. KRUSE

LIVING in rented homes is an automatic education in water heaters, if one only observes and tests a bit. My own experience has been to the general effect that there must be something like a sacred tradition against a proper installation of gas-operated hot-water systems—in spite of the fact that it does not cost any more to do a thing right than wrong.

In Fig. 1 we have an installation that is typical and is all wrong. First of all, the heater should have a pipe to the chimney, but that is a minor point and will presently be taken care of by the safety codes of all cities. The lack does not stop the heater from working. On the lower heater nipple we have an L-R coupling; a fitting with a left-hand thread in one end and a right-hand thread in the other. I have never yet seen one that did not leak sooner or later, and most of them must be taken off with a chisel—in pieces—when the job needs attention, as all heater coils do at intervals. A union should be used as in the upper connection. It costs a few cents more at first and many cents less later on.

In place of the elbow below the tank there should be a faucet, not merely to drain the system but to draw off dirt, rust and scale. It is a good idea to work that faucet a couple of times a year, partly for the reasons mentioned and partly to keep



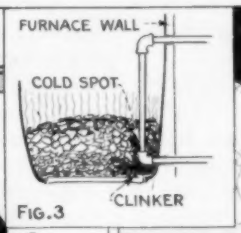
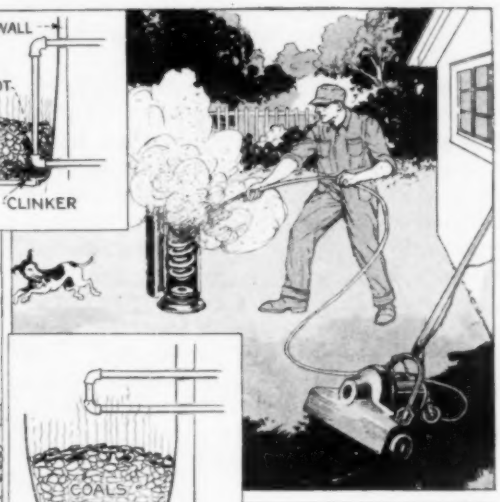


FIG. 3



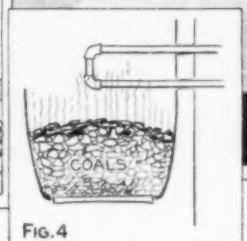


FIG. 4

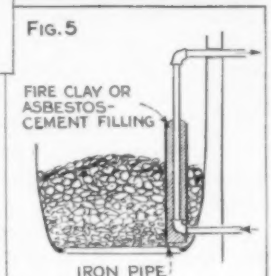


FIG. 5

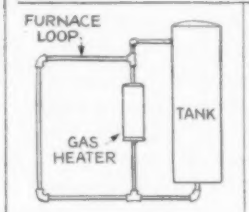


FIG. 6

it free for that time when the house must be left on a cold day and it is imperative to drain the tank.

Above the heater there is a really serious error, one that certainly is made in nine out of ten installations and which infallibly prevents them from working properly and economically.

One eastern company had at one time to employ a regular "missionary" to go about correcting this thing which was causing heaters to be denounced as no good. When the change was made they all functioned. The error itself is simple enough; the pipe from the top of the heater coil should go into the side of the tank and not the top. If connected as shown in Fig. 1, air will be certain to collect above the dotted line. This sounds harmless, but when an attempt is made to heat water the results are very slow in coming, because it is necessary to boil the water in the heater so that steam is produced and driven into the tank, taking the air along. Then, finally, the water starts circulating. But things are still wrong for we are compelled to make the whole tankful lukewarm and then hot—taking (in a test case in East Hartford) something like an hour. The same job, when changed, as in Fig. 2, would produce a small amount of boiling water in five minutes and a tankful of the same in twenty minutes.

In Fig. 2, the suggested changes have been made. The coil connections are both unions, making it possible to take the heater down from the ceiling without too much trouble. The clean-out and draining faucet has been added, though there is no special reason for the type shown—any type would do—and above the heater coil the important change has been made that triples the speed of heating. This works every time; it has been tried on dozens of jobs. The reason is partly that the air trap has been removed and circulation starts at once. In addition, the hottest water goes to the top (above the dotted line) at once, thereby giving a small immediate supply of 5 gal. or so. If your tank has no side opening to permit this connection, don't take it. Gas is expensive.

Another worth-while change has been made in running the cold water in at the bottom to prevent it from mixing with the hot water. This prevents the hot-water faucet from delivering hot water for a moment and then dead-cold water, seemingly

for no reason, as quite a few jobs do where the cold water can cut across from the inlet to the outlet.

It will be gathered from the foregoing that, if a new heater does not work, the trouble usually isn't with the heater itself.

Assuming that the installation has been made well, one naturally wants to keep it in working order. Perhaps the simplest way to do this is to cut down the amount of work it must do by padding the tank very liberally with heat insulation. If the heater is a foot or so away from the tank, it is generally safe to use a "quilt," 1 in. thick, of ordinary newspapers fastened on by a wrapping of cord or wire. This is crude, but will save half the gas easily where hot water is wanted often during the day. The real way to do the thing is, of course, to use some of the cellular asbestos lagging made for the purpose. Such lagging is also safe where the heater is close enough to endanger a paper wrapping. Once properly installed, the heater will work until soot, scale and dirt slow it down. The soot is difficult to remove with brushes and the like. My wife thought of a quicker way, which is a bit rough but very prompt. The idea is simply to use the exhaust hose of the vacuum cleaner with any small nozzle, or none at all. The soot gets out instantly, and if you move rapidly not too much will settle on you. This is a good summer job. It can be done outside because the heater should (except where the city water is chemically treated to remove lime) be taken down each summer so that scale may be removed from the inside of the coil. To do this, the heater coil is plugged at one end and commercial hydrochloric (muriatic) acid is poured in until the coil is full. When this has stood for a while, the liquid is poured out and the process repeated until acid can be run through the coil freely. After that a great deal of water is run through from the garden hose, and the heater reinstalled.

The openings in the burner may need attention also. The simplest way to clean them is with a hand drill or a twist drill of the proper size, unless the openings are in the shape of slits, which can be freed of dirt with the aid of a hacksaw or thin metal sheet notched with a file.

Several people told me lately that a tank-heater loop put into a furnace will "stop the furnace from heating" and "will never heat water and always have to be taken out again." This was indeed news, because I have lived with a great many such jobs that work beyond criticism, and have had to do with a number of others that also work well.

As nearly as I can make out, the unsatisfactory jobs were installed as shown in Fig. 3. Since the loop is often filled with quite cold water the tendency is to create a "cold spot" in the fire, as shown in the sketch, and also to cause clinkering on the grate near by, as indicated in Fig. 3.

A loop installed as shown in Fig. 4 works beautifully. The proper height of the loop above the fire depends on the coal used. For anthracite 10 in. is about right, while the long-flame soft coals can stand 18 in. very nicely. The idea is to place the coil so high that it does not chill the flame and cause sooting. If the coil tends to become sooty, it is too far down.

If one happens to own a furnace in which the openings are so placed as to compel the use of a coil of the type shown in Fig. 3, the dead spot in the fire can be avoided by using the dodge shown in Fig. 5. A piece of iron pipe is slipped over the pipe of the heater loop after having been notched so as to permit the latter to go out through the side of the outer pipe. The notch should not be made too deep, else the iron pipe will get down far enough to fight with the grate bars. It is a good idea to make the iron pipe come flush with the lower side of the elbow at the bottom of the furnace loop. The outer pipe should have an inside diameter 1 to 2 in. larger than the outside diameter of the inner one. The space between is filled with asbestos cement or fire clay. By juggling properly, the whole contrivance can be slipped into place, after which the iron pipe will heat up enough to prevent a dead spot in the fire, while the top part of the loop will heat all the water that is wanted.

When everything else has been done satisfactorily, one sometimes finds that the whole business is killed by a piping layout such as the one suggested in Fig. 6. In these, the water goes up through the one heater and down through the other while the tank sits alongside and neither gives nor takes. The effect is that, in winter, the furnace heats the gas-heater coil and in

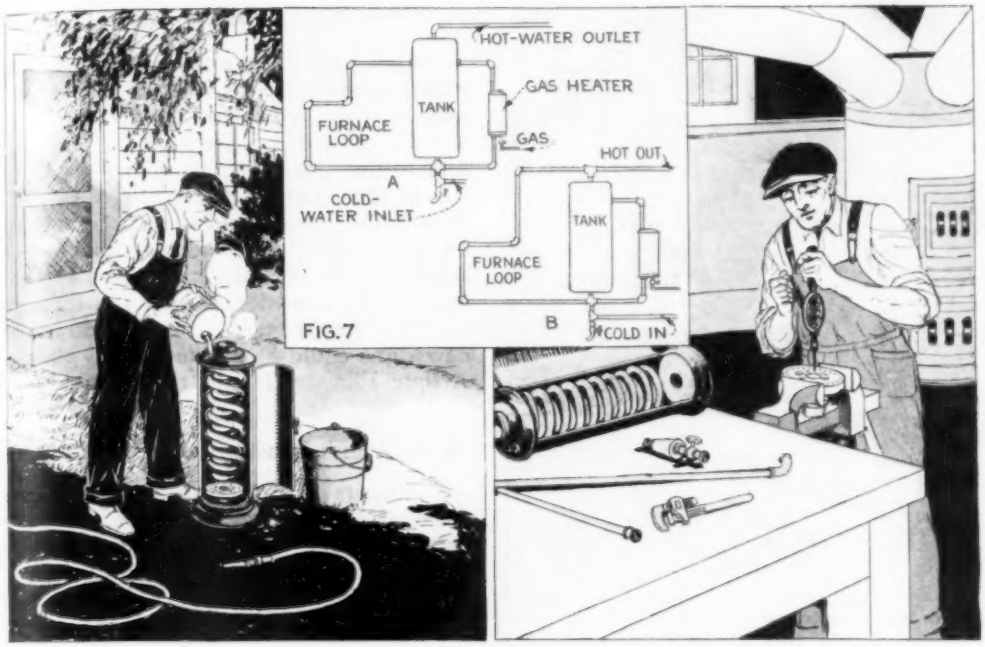


FIG. 7

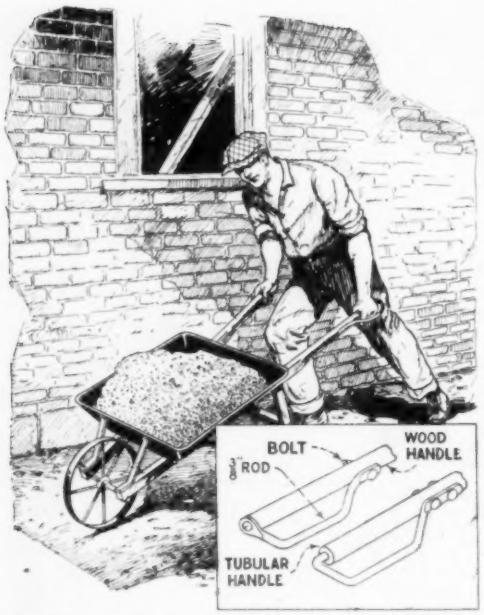
summer one burns gas to warm up the empty furnace, while the tank stays cool.

Since a furnace loop is worthless in the summertime, one naturally wants a combination arrangement. A scheme similar to Fig. 6 will work all right, if shut-off valves are placed to prevent local circulation (other than through the tank), but some one may forget to turn the valve some day and cause real trouble; therefore it is best to use one of the piping layouts shown in Fig. 7. That shown at A covers all the requirements suggested, but calls for a tank with an opening in each end and two at the sides near the top. I have seen such, but suspect they were made to order. The layout in B can be used with an ordinary tank. At first sight, it seems to violate the rule about a top return to the tank, but only the furnace loop is so returned, and, since it either operates continuously or not at all, the air-trap difficulty does not develop except once in the fall when the furnace is started, and then the trap can be broken by opening any hot-water faucet and letting the air and water escape together until the system is clear. Several drainings may be necessary as the furnace heats up the first time, after which there will be small difficulty unless the water in the loop is heated to boiling for a long time, which happens only with careless firing or with a loop too near the grate.

The danger of raising steam is frequently brought up as an objection to a furnace loop. Experimentally one was allowed to operate under conditions where this was possible. What happened was just what one would expect; the pressure did not rise above that of the city water system, but finally the loop became hot enough so that a pinhole or crack opened up and sprayed the fire, which promptly went out. The danger never did impress me to begin with and, after that experiment, it certainly does not seem any greater. Nobody in his right mind ever fired (for heating purposes) as we did to persuade the thing to let go. Inasmuch as that was a cast-iron loop, the brass ones seem doubly safe.

Friction Buttons Hold Triangle

To facilitate the use of triangles when making drawings at odd angles, it has been found practical to provide a 45° triangle with three rubber friction buttons. These buttons, made from inner tubing, should be about ½ in. in diameter and fastened to the triangle with collodion. The use of this tool obviates the customary pressure and care.



Guards on Wheelbarrow Handles Protect Workers' Hands in Close Quarters

Guards on Wheelbarrow Handles for Close Quarters

When using wheelbarrows in close quarters on construction jobs, the workers often injure their hands by scraping them against walls or other obstructions. This trouble can be prevented by attaching guards to the handles, as shown in the drawing. The guard consists of a length of 3/8-in. iron rod, bent to the shape shown and fastened to the wooden handles of the barrow with bolts and screws.—Robert D. Peebles, Bridgeport, Conn.

Preserving Shafting from Corrosion

In a laboratory it was very difficult to keep the lineshaft and countershafts bright and free from rust, owing to the fumes and gases issuing from the several fume closets within the same room. The following method was tried and proved very satisfactory: The shafting was covered with two coats of flat white paint and allowed to dry, after which a coat of white enamel was applied, giving it a clean, glossy and sanitary appearance. This eliminated all the trouble of cleaning it with emery cloth, and it also made it appear in harmony with the other furnishings of the laboratory.

Glass Window Signs

To keep his signs on the outside of his windows from being washed off by the rain, a store proprietor painted them on a piece of window glass, 24 by 24 in. in dimensions, and set this piece inside of the window against the plate glass. Although the signs could have been painted on the inside of the windows, this practice involved the difficulty of painting them backward. Shoppers would see through the glass to the goods in the window, and new signs could be painted at any time.—Arthur Flinner, Manhattan, Kans.

Scraper and Brush in One for Drilling

Operators of drill presses often use a piece of sheet metal to scrape away the cuttings from the drill plate and then clean off the surface with an ordinary flat brush. When I have work to do which requires the use of a drill plate, I keep the plate clean with a combined scraper and brush. Besides saving time, this device keeps the brush clean, eliminating the trouble of pulling out curled cuttings from it. The scraper is made of sheet metal, bent to fit the metal binding on the brush tightly. It should be set so that normal pressure on the brush brings the scraper in contact with the surface to be cleaned.—Harry Moore, Montreal, Can.

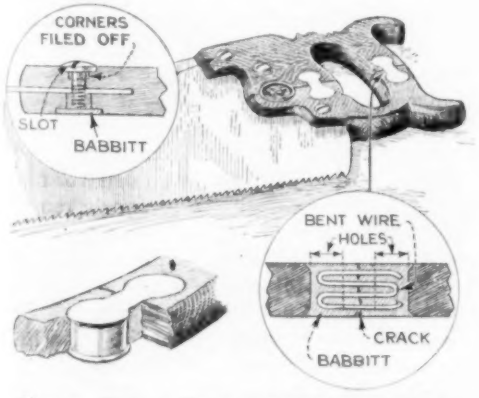
Jigsaw Blade for Cutting Hard Material

Insulating material, composition and various hard veneered stocks will quickly dull the usual jigsaw blade. One shop has adopted the use of metal-cutting hacksaw blades for jigsaw work, merely modifying the blade by grinding off the back of the blade until only about 3/16 in. of metal remains behind the teeth. This blade will

readily cut the veneers and any other hard material. Care must be taken, however, not to crowd the work or jam the saw. While it is capable of hard cutting, such a blade will not stand much bending and should therefore be given more care than is usual with soft-wood cutting blades.—G. A. Luers, Washington, D. C.

How to Repair a Saw Handle

When your favorite saw handle cracks, it can easily be repaired as shown in the illustration. Two holes, from 5/16 to 1/2 in. in diameter, are drilled on each side of the crack or break, and a saw cut is made between them. Countersink the holes on both sides and then, with one side held on a flat surface, pour in melted babbitt, which, upon hardening, holds the cracked parts together securely. It is a good idea to slip a bent wire into the slot to reinforce the babbitt, as shown in the lower detail. Put a flatiron over the babbitt before it sets, to force it down into all the hollows. After it has set, the surplus can be filed down even with the saw handle. The upper insert shows how a screw, having a stripped thread, can be held in place securely by making a babbitt nut. First put the screw in place and then pour the babbitt in from the other side. The hole for the nut is counterbored.—Geo. H. Cappel, Wilmer, Ala.



How to Make a Simple and Efficient Repair on Cracked Saw Handles

Heavy Wheel of Farm Tractor Can Be Removed Single-Handed with the Aid of This Sling

Removing a Heavy Tractor Wheel

The drivewheel of a farm tractor is usually more than one man can handle, and when it becomes necessary to remove one of these single-handed, some means has to be used to hold the wheel. This can be done by driving the tractor under a strong branch of a tree. After placing a jack beneath the axle to hold the wheel from the ground, pass a rope over the tree branch at a point above, but about the width of the wheel tire outside of the wheel. The rope is left doubled and the ends are tied together. A stick is inserted between the ropes and the latter are twisted together and then lifted slightly and tied, as indicated. After it is loosened the weight of the wheel will cause it to slide from the axle. When replacing the wheel, the rope is moved farther out on the branch so that the wheel will swing toward the tractor. The very slight movement necessary to permit pushing the wheel on the axle can be effected by twisting or untwisting the rope.

¶A column of water 27.6 in. will have a pressure of 1 lb. per square inch.

Movable Sewing-Machine Stand and Mending Cabinet

By WALTER LEWIS

Cabinet Fitted on Wheels Makes Good Support for a Table-Top Sewing Machine and Provides Plenty of Space for Equipment and Material for Sewing

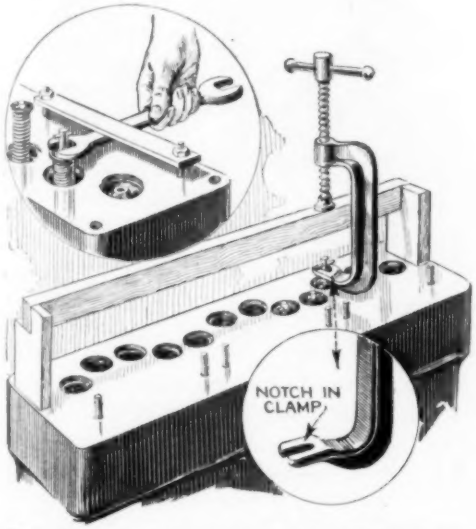
THERE are a great many women who possess a portable or table type of sewing machine, and, no doubt, most of them dislike to carry it back and forth to the spare room where it is kept. A box of mending material, thread, scissors, etc., must also be brought out every time the sewing machine is used, and this adds to the inconvenience.

For this reason a movable stand, resembling a tea cart, will be of considerable utility to hold both the sewing machine and the odds and ends, which should be at hand when the machine is used. Any kind of cabinet, box or part of a small desk will do for the body, provided there are drawers or lockers. Suitable pigeonholes can be arranged in the lower compartment, if desired. Two pairs of 10 or 12-in. baby-carriage wheels, on axles, are fastened to the underside of the stand. New wheels can be obtained for approximately $3, although old ones will do as well, provided they are in good condition. They can easily be repainted to look presentable. Two bolts through each axle are sufficient to hold them in place securely. If an electric motor is used to run the sewing machine, additional space should be calculated for the motor. The cord to the foot rheostat can be threaded through holes in the top and bottom, the cord running inside of the cabinet. The foot rheostat can then be stored in the lower compartment when the machine is not in use.

When assembling the stand, measurements should be taken to determine the most suitable height for sewing. When the machine is needed, it can readily be wheeled out. Refinishing it with varnish will add to its appearance.

Removing Overhead-Valve Cages

Overhauling the valves on some cars is often a difficult job. The drawing shows a simple and extremely efficient method of doing the job on a Buick or other overhead-valve motors. After the rocker-arm assemblies have been removed, the first step is to compress and remove the valve springs. The only equipment necessary for this is a 6-in. piece of strap iron or hardwood. Two holes are drilled in it so that it will drop over the two studs which hold the rocker-arm assembly, as shown in the upper insert. The nuts are turned on the studs above the strap, and an open-end wrench of suitable size is used as indicated. By lifting on the free end of the wrench the spring is easily compressed so that the pin can be removed. The operation is repeated for the remaining sets of valves. A hardwood rack is then made, long enough to straddle all the valves and rest on the block. A C-clamp is drilled and a notch is sawed out, as shown in the lower insert. The illustration clearly shows the method of using it, the valve pin being replaced for this operation. Valve cages that are badly stuck can be more easily started by giving the clamp a slight hammer blow, but in most cases the cages will slide out readily as the force is exerted in direct line with the axis of the cage.—Robert B. Warman, Buffalo, New York.



Easy Method of Removing Overhead-Valve Cages without Special Tools

Sanitary Sheet-Metal Holder for Cuspidors Picks Them Up Automatically

Sanitary Carrier for Cuspidors

The proprietor of a Wisconsin office building has provided his janitors with a simple device for carrying cuspidors, so that the work of removing and cleaning them can be done more easily. The device consists of a bottomless cylinder with a permanent cover, having a handle attached. Near the bottom of the cylinder are two stout self-acting grippers, made from flat spring steel. These are bent so that the operator need merely slip the cylinder over a cuspidor to engage and hold it. The cylinder is then carried to the next cuspidor, which is taken up in the same manner, and this operation is repeated until five cuspidors have been gathered. To empty the container it is placed on the floor, the two springs are pulled outward and the cylinder can then be raised.—G. E. Hendrickson, Argyle, Wis.

Two-Color Paint Job on Chair Legs

When painting or lacquering breakfast-room chairs in two colors, tie a piece of cotton cord tightly around the legs, near the bottom, where the two colors meet. The cord will absorb the paint and prevent it from running. After the job is dry, the cord is cut off.—Hiram Caulking, New Iberia, La.

Scribing a Circle without Compasses

It is occasionally necessary for the mechanic to scribe a circle when no compasses are at hand; if a square is available this can easily be done. Tack a piece of paper down on the bench-top and lay off the diameter. A small nail is driven at each end of this line, and an ordinary carpenters' square laid against the nails as indicated. The point of a pencil is held in the corner of the square, which is then swung around, keeping it against the nails, so that the corner describes a complete semicircle. The other half of the circle is scribed in the same way.

Heat as Aid in Woodworking

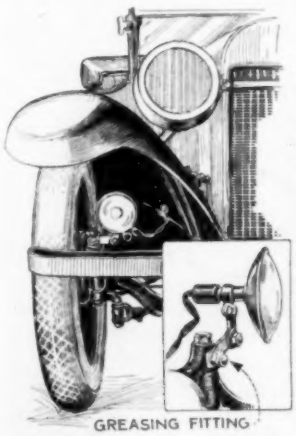
It is often desirable to fit a piece of wood into a piece of metal by means of cutting a thread in the metal and screwing the wood therein. This can be accomplished by heating the metal to a little over the boiling point of water and screwing the wood piece into the metal while hot; or, if it is impractical, on account of size, to heat the metal, make a screw plate by cutting a thread in a small piece of metal, the size and thread corresponding to the hole into which the wood piece is to be inserted, and heating it to the required temperature, then running the wood with some pressure through the thread. The wood can then be screwed into the larger piece, where it will hold firmly.

The process of heating wood without the aid of steam can be used to advantage in a number of ways; for instance, a hammer handle that is crooked can be straightened by careful heating without burning; also billiard cues, or almost anything of hardwood. It is surprising how easily it is done and how permanent the repair will be. The Indians at one time made their arrows from small hardwood twigs which were almost always crooked to start with, but after being dried they were warmed over a fire and straightened.

Another use for the application of heat is the following: When it is desired to place a screw in a fragile piece of wood that is likely to split, if the screw is heated to a blue color and turned into the wood while hot, there will be scarcely any danger of splitting. In this case do not use oil or lubricant of any kind, as the screw is sure to seize before it is driven home.

Spotlight Turns with Wheel

Spotlights are especially handy to illuminate sharp corners, but they are rather inconvenient to manipulate unless they are set at a certain angle and then switched on only while turning a corner. But as corners have different radii, the illumination often does not fall where it should, and the light is of little or no help to the driver. An improvement is shown in the illustration. The spotlight is attached to the front-wheel spindle so that it turns with the wheel. The supporting bracket can be clamped to the spindle, or, if a stronger attachment is desired, the alemite fitting may be removed and a small bolt, running through a hole previously drilled in the light bracket, substituted. However, if this method is used, the bolt must be removed to permit greasing the king pin.



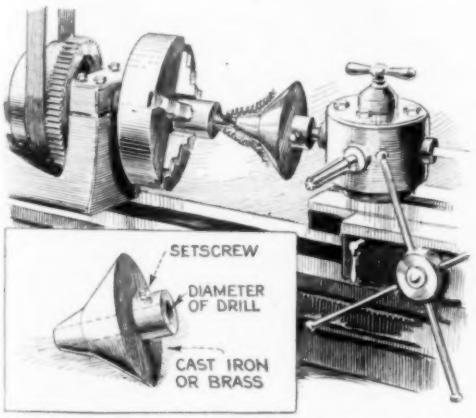
¶A small piece of rosin stirred into melted babbitt will improve and make it run better. The rosin-treated babbitt will run into places where the plain will not.

Kinks in Washing Photographic Negatives and Prints

Photographic defects, spots, stains, etc., are often due to insufficient washing. In the common method of washing negatives or prints under the tap, in a dish, the water is not changed quickly enough. If the negatives are placed film downward and supported at the edges, the washing is quicker and more thorough. Films as well as glass negatives are in the same class in the matter of washing. Films should not stick together, and the sharp edges must not be permitted to cause scratches.

Chip Guard for the Drill or Lathe

Drill chips are more or less of a nuisance around automatic machines, especially those long endless chips which get into stops or ratchets and clog the machine. It is possible to prevent these chips from working back, if a chip guard of the type shown in the drawing is made and attached to the drill, outside of the cutting depth. Make the guard of iron or steel, forming an abrupt cone, to turn the chip. Tap for a setscrew, which will hold it securely to the drill or the drill socket. This fixture is of service in either the automatic lathe or in the spindle of multiple-spindle drills of the type that uses numerous stops and automatic features.



Cone-Shaped Device for Turning Away Long Chips on Automatic Machines

Side Guards on Shop Grinder Prevent Injury to Workman

Side Shields for Polishing Wheel

A favorite way of polishing long slender rods is to pass them over the top of the wheel. This allows greater freedom for the arms than any other way, but is rather dangerous because the rod is likely to slip off the side of the wheel and cause injury to the operator. To prevent this is a simple matter: Make two metal guards, a little larger in diameter than the wheel and fasten them in place with the regular washers and nuts used on the machine, as shown in the illustration. The guards effectively prevent side slip.

An Acid Test for Steel and Iron

File, or grind, the pieces to be tested and polish them smooth, then place them in a dilute nitric or sulphuric-acid solution for a day. Wash and dry the pieces, and if they are of the best steel, the surface will have a frosty appearance. Ordinary steel will have a honeycomb surface, and iron will present a fibrous structure running parallel to the direction in which the metal was worked.

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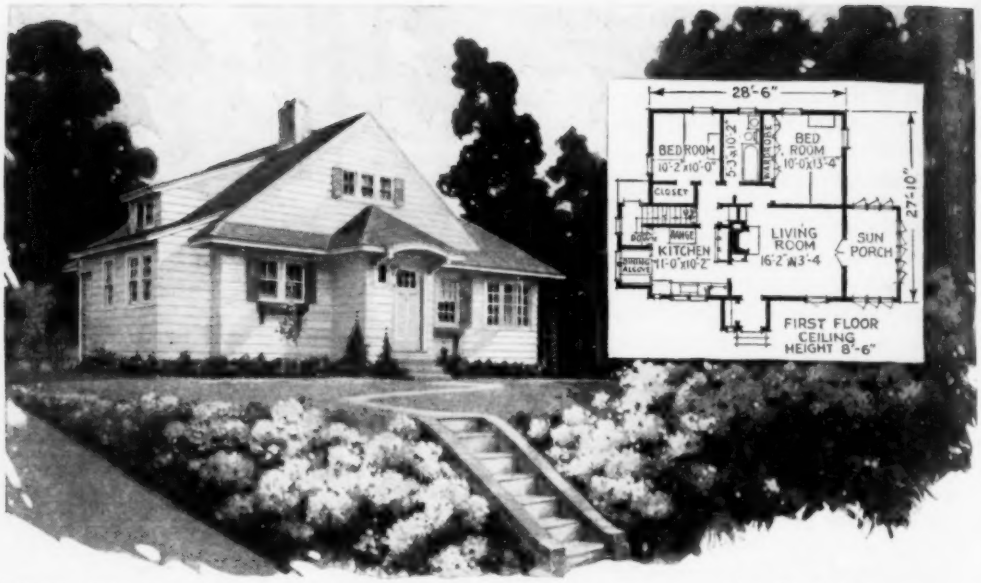
Is This Your Home?



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Plan No. 4A13

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A SUCCESSFUL home is a combination of a pleasing, well-designed exterior and a good practical plan. Good construction is the third necessary element. This house has been designed to provide a workable plan for a small family. The windows, doors and walls of the house are proportioned and little touches have been added so as to take it distinctly out of the commonplace. Also every acknowledgment has been given to the necessity of sound and economical construction.

The design brings out the natural beauty of the wood finish. The wide siding gives a splendid texture to the walls. A so-called Germantown hooded roof, broken to emphasize the entrance, recalls the old Pennsylvania houses. Its style, however, is not a slavish following of a tradition.

There are four excellent rooms, two of them bedrooms, and in addition a commodious sun porch, which may be open if it is desired to decrease expense. A good-size dining alcove, off the kitchen, should be sunny and pleasant because of the two windows at the head of the built-in table. Linen may be kept under the seats and china in a closet above them. The living room has a large open fireplace with built-in bookcases adjacent to it at one end and a little cupboard built into the chimney on the other.

There is plenty of space here for a family of three or four. The bedroom to the left might readily be made into a sewing room with a modern folding bed designed to go into the large closet. The plan may be swung around in many ways to vary the effect, but the house should be placed so that the living room and sun porch have southern exposure.

The construction is wood frame with wide siding as a finish, shingle or composition roof, and cement base course.